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READING HOUSE PLANS
BLUE PRINT READING
FOR
THE BUILDING TRADES

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READING HOUSE PLANS

BLUE PRINT READING
FOR
THE BUILDING TRADES

BY

HARRISON C. GIVENS, Bs. Ed., M.E.
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AUTHOR'S PREFACE

An analysis of the Building Industry shows that there are several groups of people who have to deal with architect's working drawings, or building plans. Some of these groups are highly specialized. The character of their trade knowledge varies greatly, yet there is a common body of knowledge which must be familiar to all when interpreting building plans. The contractor, the foreman, the dealers in building supplies, and the workmen must use the plans and specifications furnished by the architect. Often the same set of plans are used by all, and a general knowledge of what is given on a set of plans enables each to interpret his particular part of the work more readily and correctly.

While modern construction methods have created some jobs for which a knowledge of drawing is not essential, there are still many jobs in which the ability to read blue prints will always be necessary. The foreman must be able to give to others the information shown on the plans and specifications and every first-class mechanic should be able to interpret the lines, symbols, indications and notes found on a set of plans.

In preparing this manuscript it has been the author's primary object to prepare a set of instruction notes for those employed in building construction, and at the same time to provide a text for evening trade extension and other classes for those interested in the building industry.

It is recommended that these notes be supplemented with a study of the plans and specifications of buildings erected in the local community. Type questions similar to those given in the text should be used.

The author wishes to express his appreciation of the assistance rendered by others in the preparation of this manuscript and to acknowledge his indebtedness to Mr. J. J. Haralson of Haralson & Nelson, Architects, Fort Smith, Arkansas, for his valuable suggestions and permission to use the blue prints embodied in this manuscript.

H. C. Givens.

EDITOR'S PREFACE

The author's approach to the subject matter in this book is unique and is based upon his past experiences in providing instruction suitable for apprentices and journeymen workmen in the building trades. Where the instructor uses this book with a class of practical men he will find it of very great value in stimulating discussion and in insuring a complete covering of the subject for at least one average building project. Additional sets of plans can then be secured, as needed, for the purpose of giving a wider range of instruction under different types of construction.

J. C. Wright, *Editor.*

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READING HOUSE PLANS

CHAPTER I

GENERAL PRINCIPLES

Plans. *Set of Plans or Working Drawings.* The plans or, more correctly, a set of plans consists of several drawings which give the location and sizes of the constructive parts of a building. The drawings in a set of plans fall into three groups. One group, known as the floor plans, shows the horizontal locations and sizes of the constructive parts of the building and indicates the position of equipment. In other words, the floor plans give information in regard to areas of floor surfaces, position and dimension of partitions. A second group of drawings, known as the elevations, serves the double purpose of showing the projected appearance of the building on a given side when completed, and gives information in regard to positions, sizes, and designs for vertical surfaces. A third group of drawings, known as details, serve to show certain materials of construction and the manner in which the material is to be assembled. Detail drawings fall into two large groups: Framing or construction details, which give information in regard to sizes and method of construction of the building; and mill details, which show the size and methods of construction for such parts of the building as doors and door frames, windows and window frames, interior trim, etc.

The Scale. The drawings which constitute the set of plans are made to scale—that is, every part of the building is reduced in the same proportion on the drawing. In this way the lines on the drawing which represent the constructive parts of the building bear the same relation to each other as the constructed parts of the building which they represent are to bear to each other. A scale is made by taking any desired distance to represent 1 foot and dividing it into 12 equal parts to represent inches. The desired distance is determined by the size of the building and space for the drawing. This scale when placed on the drawing gives the same reading in feet and inches as the foot rule gives when placed on the building. One of the common scales used on plans is $\frac{1}{4}$ inch equals 1 foot. That is, $\frac{1}{4}$ inch on the drawing represents 1 foot on the building. A part of the building which is to be 16 feet long would be shown 4 inches long on the drawing. For convenience and accuracy drawings are dimensioned and the figured dimensions are to be used.

Lines. In drawings, all visible edges of an object are shown by solid lines, ———. Invisible or hidden edges, when shown, are shown by dotted lines, · · · · · Dimensions are shown on dimension lines terminating in arrow points, ← 4″ →. The points of the arrows show the surfaces or lines between which the measurement is taken. To prevent dimensions from being confused with lines of building, the lines between which the dimension is taken are often continued outside the object with a break, and the measurement is then shown as between these extensions or witness lines. The extension lines and the dimension lines are usually lighter than the lines of the object. The dimensions are given in feet (′) and inches (″), as 6′ 4″, or in inches only, as 60″.

Floor Plans. Floor plans are those drawings of a set of plans which show the location and horizontal sizes of the constructive parts of the building, such as footings, piers, chimneys, walls, partitions, etc. They indicate the locations of windows, doors, stairs, cabinets, as well as electric, plumbing, and heating fixtures. They also give other information necessary to show how the building is to be constructed that cannot be shown to a better advantage on other drawings.

Separate or combined plans are usually made for footings, foundations, basement, each floor, and the roof. The number of plans depends upon the size and character of the building. In some cases a lot plan or engineer's drawing, showing the location of the building on the lot, landscaping, etc., is included in a set of plans.

A floor plan shows what would be seen looking directly down from above if the building was cut horizontally at a designated place and the upper part removed. The designated place is determined by the particular floor plan shown. For example: in a first-floor plan the cut is between the first and the second floor and the drawing shows the horizontal positions and sizes for the first floor.

Sections. Whenever an object is cut by a plane in this manner the resulting drawing is a sectional drawing, sometimes called a section. The term section is also used to designate the indications used to tell different kinds of material when cut. From the technical standpoint, whenever a section is taken, the pieces which would actually be cut are indicated by some standard convention or section. Architects, however, do not always follow this rule, hence floor plans may or may not show standard sections of material. They do, however, show those indications, conventions, or symbols used by architects to represent windows, doors, fixtures, forms of construction, etc. These indications give facts necessary for the construction of the building. In order thoroughly to understand a set of plans it is necessary to know the meaning of both standard and special kinds of sections, indications, conventions, and symbols which may appear on a set of plans. Figure 1 gives, for the more common conventions, those that are more or less standard practice. Any other methods or styles that plainly show its purpose may appear on the set of plans.

Elevations. Elevations show the proportions of the vertical surfaces on the side of the building which is designated in the title. Thus: the front elevation shows the front of the building. Surfaces which are oblique to the vertical surface designated in the title would also be shown, but not in their true shape or size. For example: the roof.

Horizontal dimensions, shown on the elevations, may be secured from the floor plans. Vertical heights on elevations are shown in the same proportion and the dimensions may be secured from the elevations. In some instances vertical dimensions are also given on floor plans or framing details. In any case, frequent reference to floor plans and other drawings for the correct interpretation of elevations is necessary.

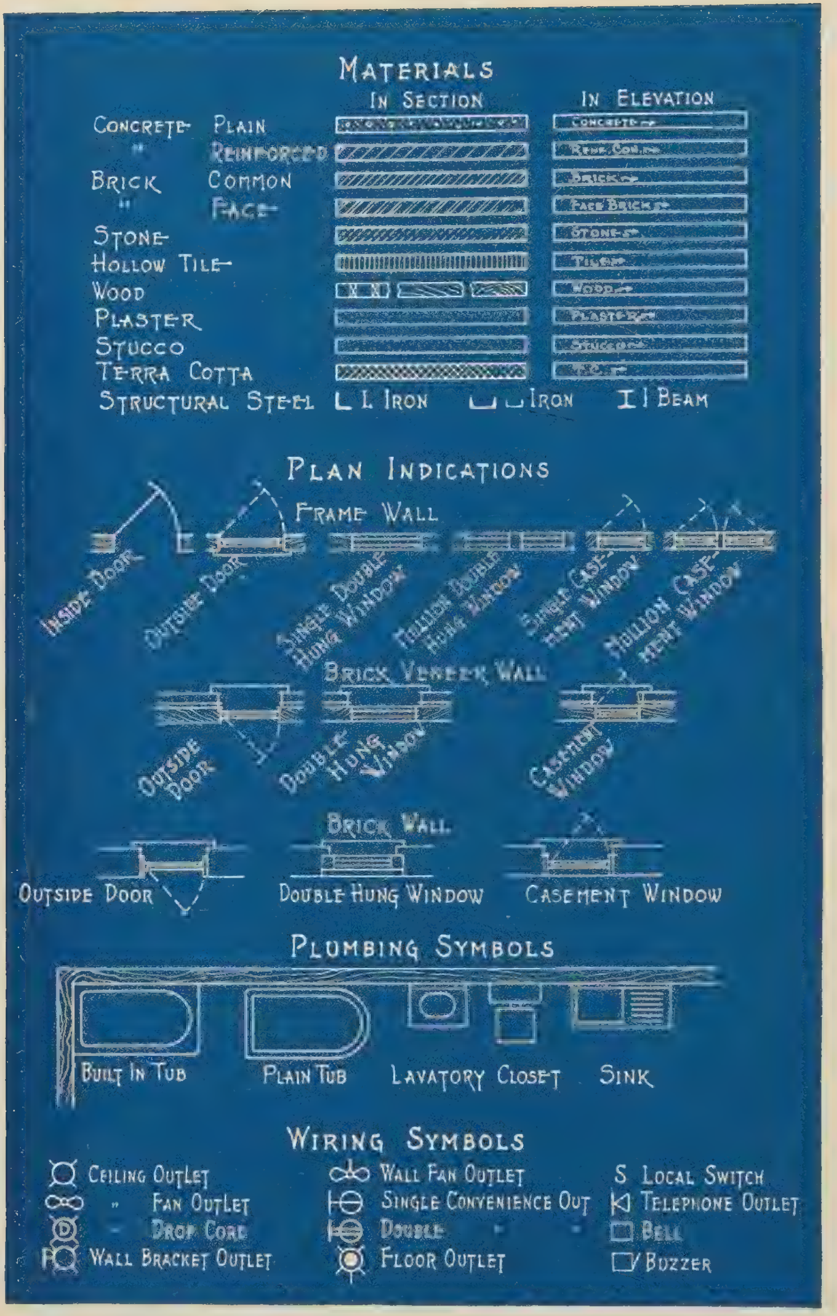


Fig. 1.—Standard Conventions.

When vertical distances, such as porch columns and rails, are not shown on the elevation, a detailed drawing giving this information will be found somewhere in the set of plans. Heights which could be shown on any or all elevations may appear only on one—as the distance from finished floor to ceiling. The size of the windows is usually given on the elevation, and also on the plan in the same manner that doors are shown. The first dimension in the window or the dimension above the line gives the width of the glass for standard two-sash windows. The space occupied by the sash and glass, *i.e.*, the opening, is determined by standard mill practice. Casement windows are dimensioned for the opening. Details for cornices and exterior coverings are usually necessary and are shown in Framing Details.

Detail Drawings. Detail drawings fall into two groups. Those which show the framing or construction are called framing, wall, or construction details. Those which show the finish, moldings, and other parts to be made at the mill are called mill details.

Framing or Construction Details. Construction details are sections through some part of the building. They show how the building would look if cut along the line (plane) at which the section is made. They show the material of construction, the manner in which the material is to be assembled, and other information in regard to the construction of the building which cannot be shown on the plans and elevations. A section taken through the building cutting it the shorter way is a cross-section; one through the building the long way is a longitudinal section. Complete cross and longitudinal sections are seldom used except on large buildings, small details showing type construction through certain places being all that is needed on small buildings. Construction details are necessary to avoid misunderstanding. For example, in frame buildings, sills are constructed in two classes: those resting on piers (Fig. 2) and those resting on continuous bearings (Fig. 3). In each of these classes of construction there are several standard types of sills that are good construction, and unless a detail is shown, any type in the class required may be used. Sills resting on piers should be made sufficiently strong as beams to carry the weight upon them from pier to pier, the size of the sill being determined by the load and the distance between piers. In sills with continuous bearings the only points where the strength of the sill as a beam has to be considered are the openings under the sills, as doors and windows.

Cornices are generally classified as open or skeleton (Fig. 4) and box (Fig. 5). In each of these classes there are several types and the details must show which type is to be used.

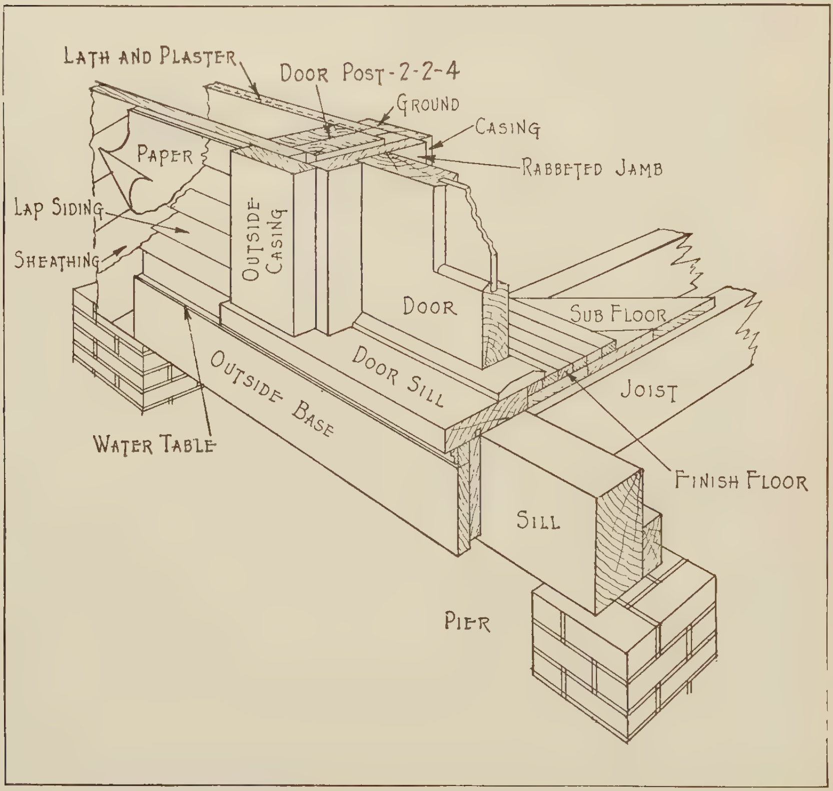


Fig. 2.—Sill Resting on Piers. Showing Sections through Outside Door and Casing.

There are numerous types of walls, as frame (Figs. 2–5), brick veneer (Fig. 6), brick (Fig. 7), each of which requires special consideration in the construction of sills, eaves, lintels, window frames, etc.

In each of these groups there are various standard types of construction. Framing details for openings are often shown in connection with the details for the trim of these openings. For example, the size of the glass in a double-hung window and the height of the sill from the floor may be given on the elevation. The detail will show the type of framing expected, the clearance to be allowed, and the type of trim to be used. Standards fix the size of the sash, and the builder must know or be able to determine the opening in the frame which is necessary to take a given window or door.

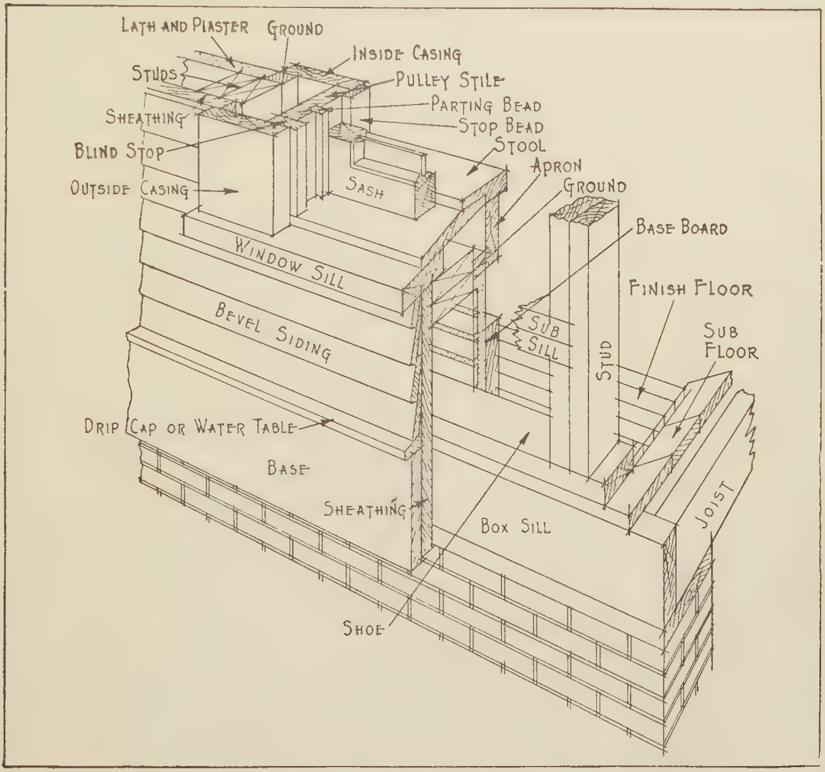


Fig. 3.—Continuous Bearing Sill Showing Section of Window.

Mill Details. Mill details include drawings which show the shape or section of the various moldings used throughout the building, unless the same are standard and designated by name and number on the plan or elevation. It also furnishes information which is needed by the mill man to make the door frames, casings, window frames, baseboards, moldings, mantels, cornices and built-in cabinets, in fact, all work which has to be or can be done at the mill and sent to the building ready to assemble. There are many types of construction for each of these. For example, the door or window frames and casings may be in an almost endless variety, and the particular style which is to be used in the building is shown on the detail drawing. There is at present a tendency to standardize a large amount of this work, and in the case of openings for windows it has become almost universal. What is known as the standard, the universal, or the Western layout is used in establishing the size of the openings. The openings for check-rail windows inside of frame is determined by the size of the glass and the surrounding sash. The following is the standard as adopted:

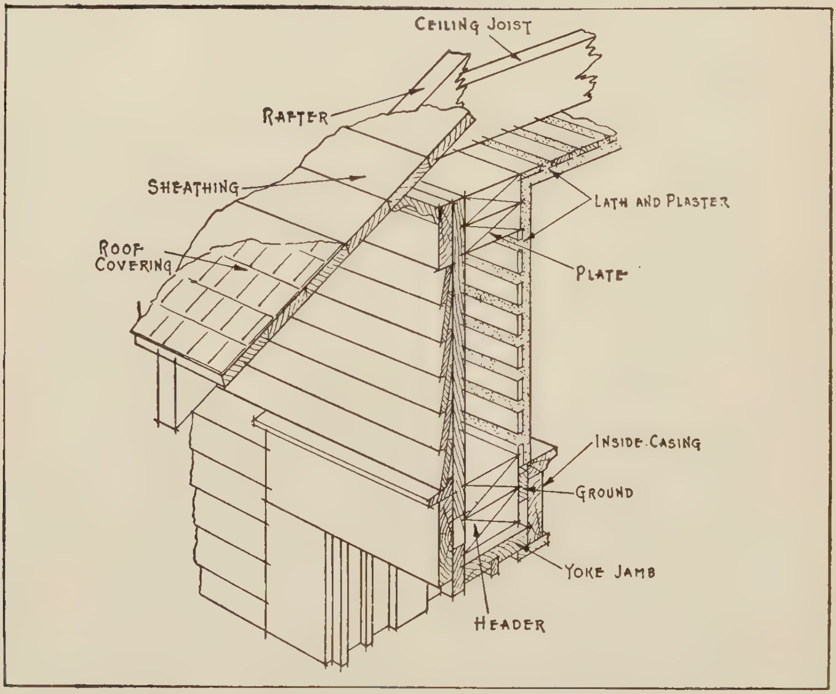


FIG. 4.—Open or Skeleton Cornice.

ADD FOR WOOD OVER GLASS OPENINGS

2-light windows	1⅜ check-rail	. . . Add 4″	width,	6″ height
4- “ “	“	. . . Add 5″	“	6″ “
8- “ “	“	. . . Add 5″	“	6″ “
12- “ “	“	. . . Add 4½″	“	6″ “

A reference to any book of standards published by the various lumber companies will show standard windows, doors, casings, sections of baseboards, and moldings.

The information in regard to mill details which is given by the architect is sufficient to enable the mill to construct the millwork in accordance with its standards, and such special construction as he may introduce. This necessitates a thorough knowledge by the architect of the standards which the mill uses in order that the piece when completed will fit into the building exactly as intended. An architect may give the glass sizes on the window and show detail sections through the sill, head, and casing. The mill determines the length of the stock beads, aprons, stools, and head casing, and assembles the frame which will carry the required size of glass, ready to go into the building. The contractor must so frame the building that this window frame will fit properly. The practice in regard to mill details varies in different sections of the country.

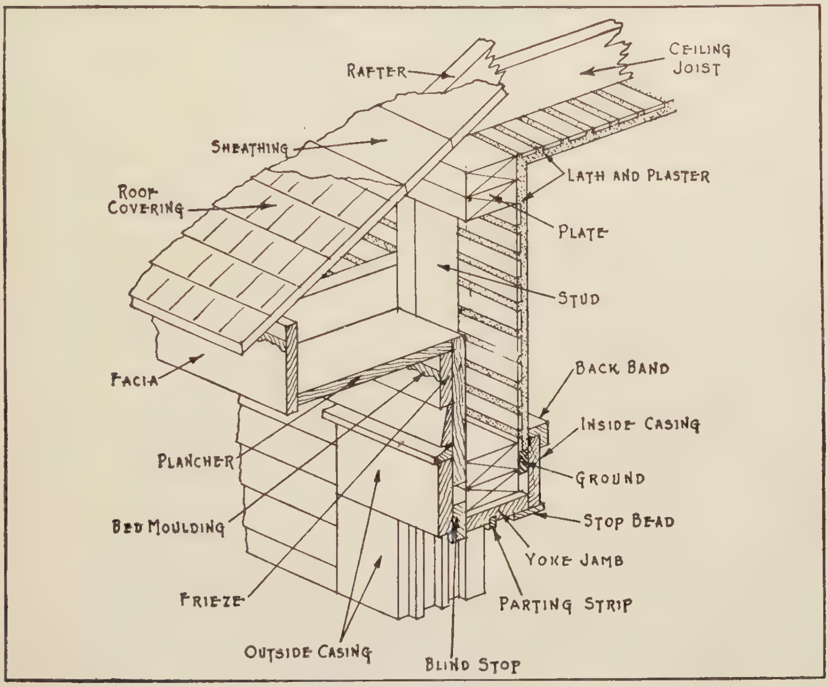


FIG. 5.—Box Cornice.

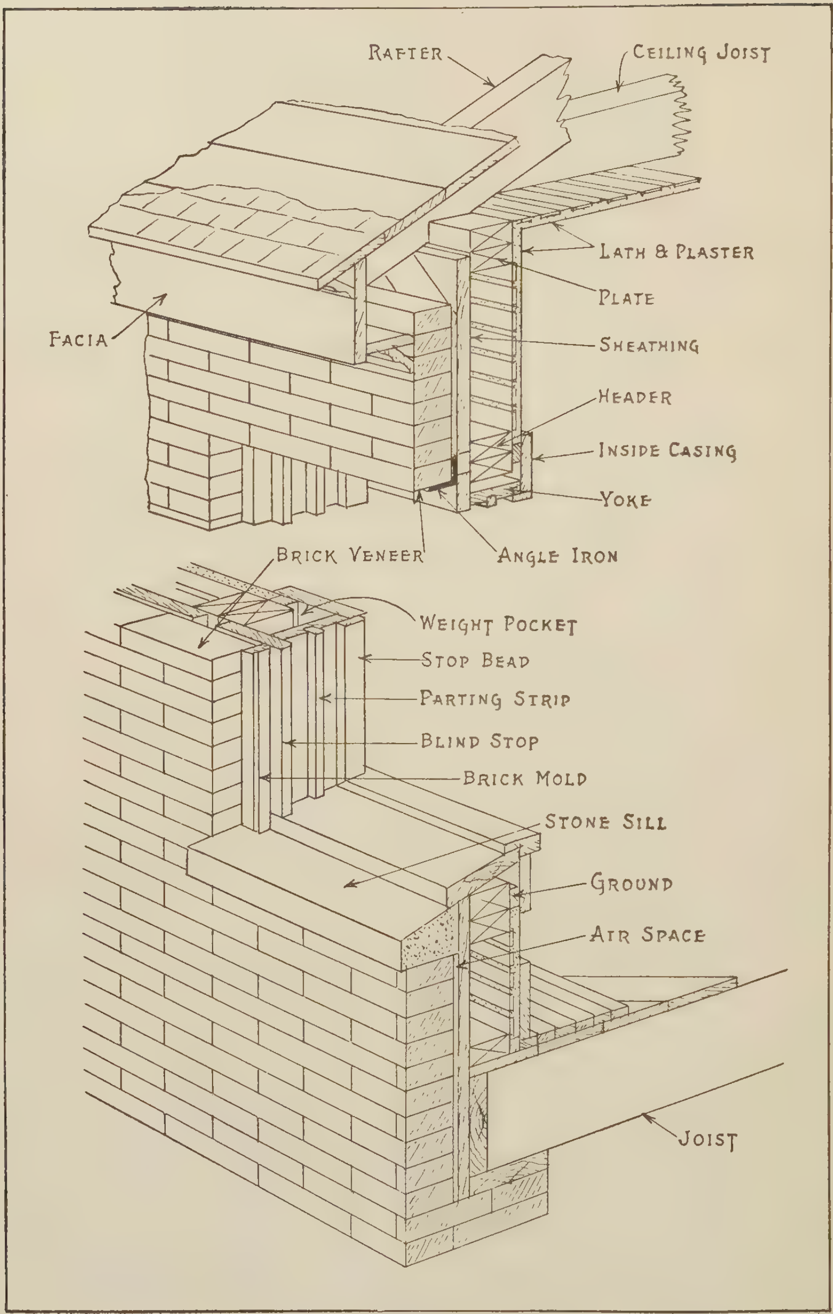


FIG. 6.—Brick Veneer.

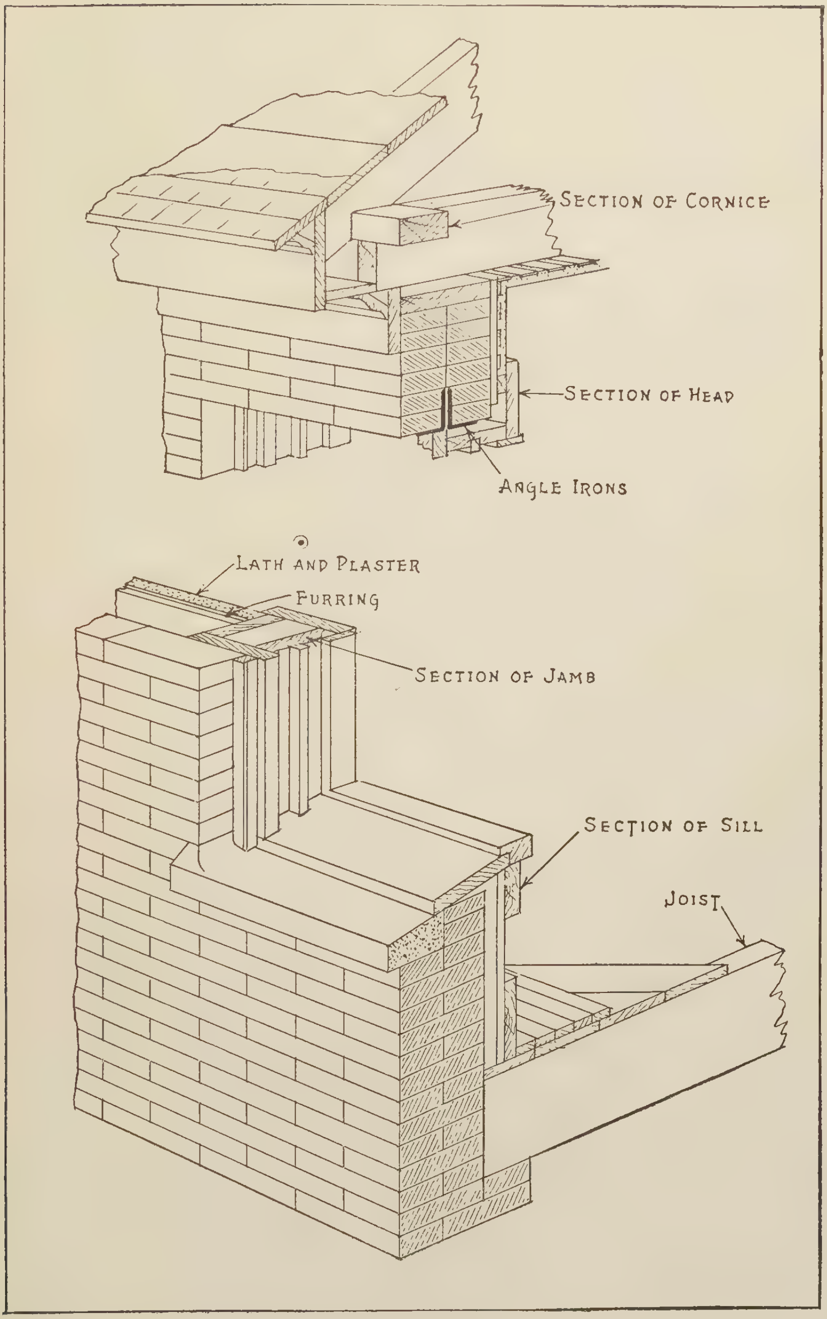


FIG. 7.—Brick Wall.

Specifications. Specifications give the general conditions which are to govern the work and specific data in regard to materials. They include such general items as the workmanship, the securing of necessary permits, compliance with city ordinances, the letting of sub-contracts, supervision, and similar items in regard to the work in which there might be a misunderstanding. They give specific data in regard to the kind, types, sizes of material to be used, and where and how they enter into the constructions. Specifications often include regulations governing bids and letting of contracts. Specifications and the accompanying drawings (set of plans) are intended to describe and provide for a finished piece of work. Items which have been standardized by universal practice in a given community are sometimes omitted or the statement that they are standard may be included—for example, " all electric wiring to be done in accordance with Fire Underwriters' regulations."

General Information. In connection with building construction there are a number of important factors which should be considered. A knowledge of what these are and their importance is needed by the owner if he is to get the best results for the money invested; by the contractor and those working under him, in order to get the required results with the minimum of time and effort, and to avoid mistakes.

1. *The Plans and Specifications.* These give all the information needed by the general contractor to construct the building. A knowledge of these is essential for some and desirable for all who have any connection with the construction of the building. Failure to have these properly executed and failure to properly interpret them is the cause of most disputes and losses in connection with building construction.

2. *Ordinances and Regulations.* Many localities have regulations and ordinances that may affect the design of the building or the conditions which govern its construction. These may include: regulations governing the kind of construction in certain areas; regulations in regard to such work as plumbing, heating, electric wiring—including installation and inspection; regulations in regard to securing building permits; regulations in regard to contractor's license; regulations in regard to use of streets adjacent to grounds; regulations requiring approval and filing of plans

with City Engineer; regulations in regard to insurance, both fire and liability; regulations governing the location of buildings on lots.

3. *Design of Buildings.* All buildings should be designed by those who have special training for the work. The employment of a professional adviser has been proved of value both economically and aesthetically. Some states require a state license to practice architecture. To secure such license one must pass an examination. One of the important reasons for this requirement has to do with the safety of persons who use the buildings. In designing a building some of the factors which have to be considered are:

(1) *The exterior appearance of the building.* A well-designed exterior improves the appearance and increases the value of a building with little or no additional cost.

(2) *Standard construction.* In buildings of a given type the kind of construction used is in general the same. Any material change from the standard usually slows up work and increases cost.

(3) *Standard materials.* Kinds, sizes, and grades of material suitable for a given type of building are more or less standard. Builder's supply houses carry these in stock. Others have to be made special at an extra cost.

(4) *Size of constructive parts.* Every part of a building designed for a given purpose must be correctly proportioned to safely carry the load and strains which may fall upon it. This necessitates a knowledge of floor loads, snow loads, wind loads, and strength of materials under different conditions. Architects have this information at hand for use in preparing plans and specifications; in addition they let the contract, supervise the work, and check materials. To-day it is generally considered advisable to employ a competent architect even when constructing small buildings.

CHAPTER II

GENERAL PRINCIPLES OF WORKING DRAWINGS

Working Drawings. A working drawing consists of two fundamental parts:

1. The drawing, which shows the correct shape and proportion of the object. In making the working drawing, fundamental principles of mathematics are used. These principles never change; they are universally the same and need not be translated from one language to another; hence anyone who is sufficiently familiar with them can read the drawing.

2. The data, which include the dimensions, giving the exact size of the object, and notes which give additional information in regard to material, processes, and other information needed in making the object. This information is given in the language of the country in which the drawing was made. Sometimes it has to be translated into a different language when the work is to be done in a different country.

The Drawing. The drawing is based upon the principle that *a point* can be definitely located when its position in regard to three intersecting planes or surfaces is known. If *a point* is 6′ from the ceiling, 3′ from the south wall, and 4′ from the west wall of a room, its position in the room is definitely fixed. *The point* can be located exactly by finding on the ceiling a point 4′ from the west wall and 3′ from the south wall and measuring from this point down 6′ at right angles (perpendicular) to the ceiling. *The point* found on the ceiling is known as the projection of *the point* on the ceiling, and gives the position of *the point* in relation to the south and west walls. *The point* can also be located by finding in a similar way its projection on the west wall and south wall and making the correct measurements from these projections. The three wall surfaces are planes, and are perpendicular to each other.

The three planes used in working drawings are perpendicular to each other and are the horizontal, vertical, and profile planes (Fig. 8). In the illustration the ceiling corresponds to that part of the horizontal plane (Fig. 8) which is behind the vertical plane, or *GLM*. The south wall corresponds to that part of the profile plane cut off (intercepted) by the horizontal and vertical plans, or *OLM*. The west wall corresponds to the lower part of the vertical planes, or *GLO*. The angle formed by the three intersecting planes shown is known in orthographic projection as the third dihedral angle, or the third angle of projection and forms the basis for making working drawings.

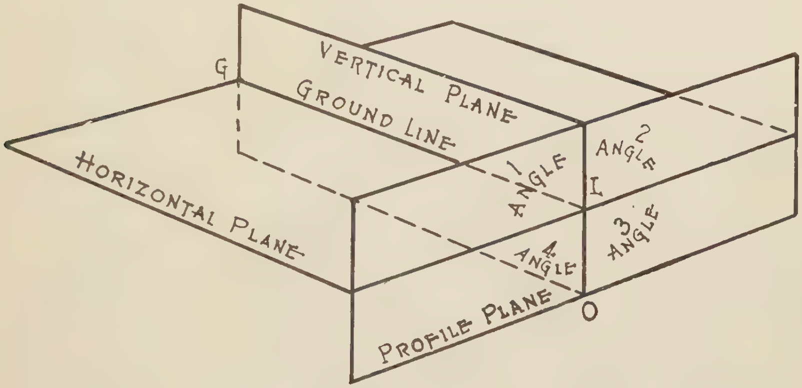


FIG. 8.—Planes Used in Working Drawings.

In Fig. 9 the third angle is shown by itself. *A point* in the third angle is shown with its projection upon the horizontal plane at *A*, upon the vertical plane at *B*, and upon the profile plane at *C*. The projection of *a point* upon a plane is the point where the perpendicular, from *the point* to the plane, pierces the plane.

The projection of *a point* fixes its position in relation to the planes. The distance of *the point* from the horizontal plane is shown on the vertical plane and is the distance from its projection on the vertical plane, *B* (Fig. 9), to the line of intersection of the vertical plane, with the horizontal plane, *GL*; or, the distance *BX* (Fig. 9). This distance is also shown on the profile plane as the distance from its projection on the profile plane, *C* (Fig. 9), to the line of intersection of the profile plane with the horizontal plane, *LM*, or, the distance *CY* (Fig. 9).

In the same way the distance of *the point* from the vertical plane is shown as *AX* in the horizontal plane and *CZ* in the profile plane. The distance of *the point* from the profile plane is *BZ* in the vertical plane and *A Y* in the horizontal plane.

Since one point can be located by its projection on the three planes any number of points can be located in the same way.

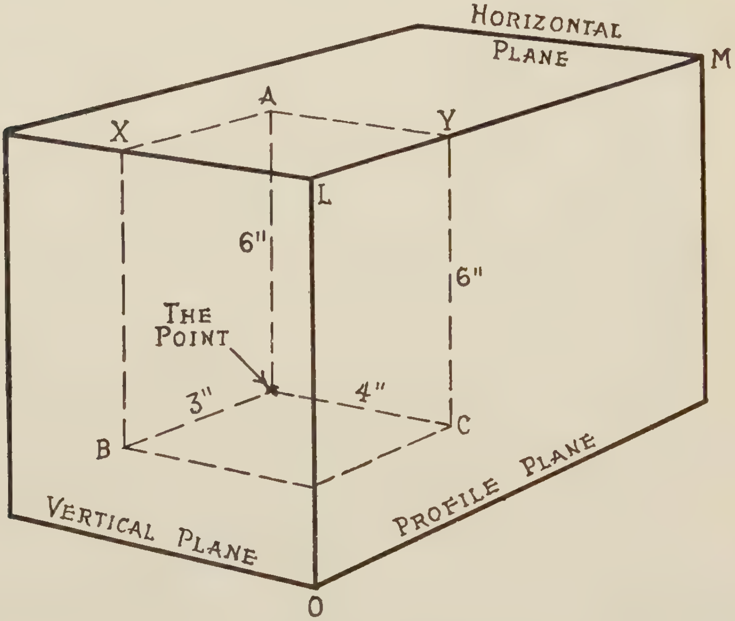


Fig. 9.—The Third Angle of Projection Showing a Point with Its Projections.

In Fig. 10 is shown a rectangular block with its projections upon the horizontal, vertical, and profile planes. The projections upon the horizontal plane show the distance of all points from the vertical and profile planes; hence it shows the horizontal relation which the points and lines of the block bear to each other. It gives the horizontal shape and proportion of the object, and shows what would be seen by a person looking at the object from above, with the line of sight perpendicular to the horizontal plane. The projection upon the horizontal plane is known as the plan.

The projection upon the vertical plane shows the distance of all points from the horizontal and profile planes from the front, and is called the front view, or front elevation. The projection upon the profile plane shows the distance of all points from the horizontal and vertical planes; hence it shows the profile relation which the points and lines of the block bear to each other. It gives the shape and proportion of the object when viewed from an outside position perpendicular to the profile plane, and is called the end view or side elevation.

These projections are found on planes at right angles to each other, and the problem is how to represent all three projections on a single sheet of paper in such a way that the relation of each projection to the line of intersection of the planes may be known.

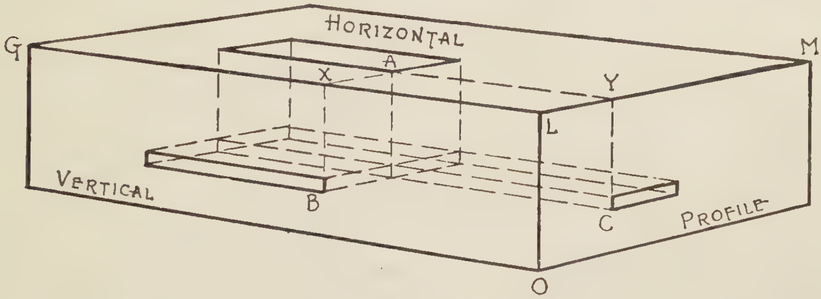


Fig. 10.—Third Angle of Projection Showing a Rectangular Block with Its Projections.

The intersection of the horizontal plane with the vertical plane is known as the ground line (*GL*, Figs. 8–10) and is the base line for the drawing. The intersection of the vertical and profile plane is *LO* (Figs. 8–10). The intersection of the horizontal and profile planes is *LM* (Figs. 8–10).

If the horizontal plane is revolved around its intersection with the vertical plane, *i.e.*, around *GL*, until it coincides with the vertical plane, the horizontal projection will be directly above the vertical projection (Fig. 11). If the profile plane is revolved around its intersection, *OL*, until it coincides with the vertical plane, the profile projection will be to the right of the vertical projection (Fig. 11). Since all planes have been revolved into the vertical plane, they can be represented on a single sheet of paper, and the relation of the points to the planes readily determined. The intersection of the horizontal plane with the profile plane, *LM*, will, when rotated, as part of the profile plane, be a continuation of the ground line, or *GLM*. When it is rotated as part of the horizontal plane it will be a continuation of the intersection of the profile and vertical planes, or *OLM*, which is perpendicular to the ground line (Figs. 11–12).

When the planes are rotated into the vertical plane the projection of a point retains the same relation to the lines of intersection of the planes, *i.e.*, the projection *A* (Figs. 9–10), does not change its relation to *GL* or *LM*, neither does the projection *C* change its relation to *OL* or *LM*. The distance of the point below the horizontal plane is the distance which its projection extends below the ground line. Since this distance is the same in both the vertical and profile views the projections must be in the same line, parallel to the ground line and below it (Fig. 12). In the same way the distance of the point from the profile plane is shown by the distance which its projections extend to the left of a line *OLM*. Since this distance is the same for both projections they would be in a line perpendicular to *GLM* (Fig. 12). In the same way the distance of the point from the vertical plane is shown to the right of *OLM* below the ground line, and above the ground line or back of *GLM*.

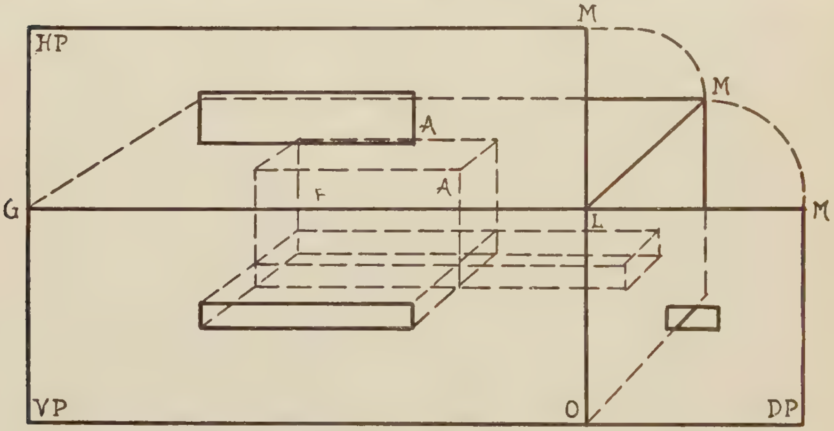


FIG. 11.—Third Angle of Projection Showing Rotation of the Horizontal and Profile Planes into the Vertical Plane.

We are dealing with the shape and proportions of an object rather than with their relations to fixed planes; and since the projections of the object upon the three planes have definite relations to each other when the planes are revolved into the vertical planes, it is not necessary to retain, and is seldom necessary to use, the line representing the intersections of the three planes, or other auxiliary lines.

To obtain the other elevations and views common in working drawings of buildings, profile planes to the rear and left of the object are used. The projections of a point on these planes and the rotation of these planes into the vertical plane to secure the rear elevation and left side elevation involve the same principles as those used in securing the front elevation and the right side elevation. The five views can then be shown as in Fig. 13.

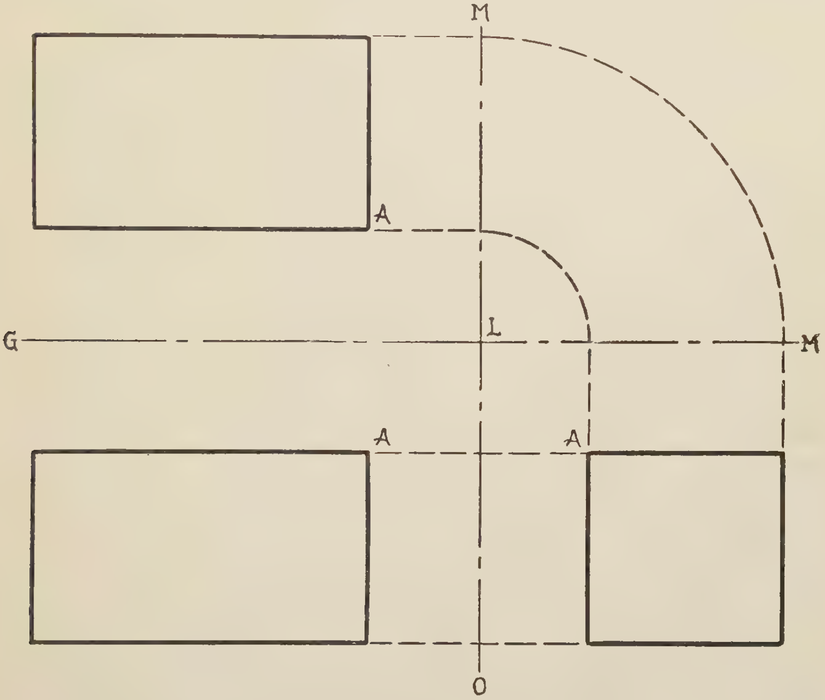


FIG. 12.—Projection of Rectangular Block Shown on One Plane with Auxiliary Lines.

In building plans people are dealing with the shapes and proportions of large objects and it is usually impractical to show the various views arranged as in Fig. 13. Whatever the arrangement of views used, even if only one is shown on a sheet, the drawing is made by the application of these principles, and if drawn to the same scale the drawings can be arranged to appear in the same relation to each other as in Fig. 13. Frequently it is necessary to take two drawings and lay them side by side and carry the projection lines across as explained and shown in connection with Fig. 12 in order to make clear some part of the building.

Blue Prints. In the construction of a building more than one set of drawings is required and the original drawing is traced on transparent paper or cloth and a blue print made. Blue-print paper is a clean white paper, one side of which has been coated, in a dark room, with a chemical solution. If the prepared paper is washed before being exposed to the light the water will remove the chemicals and the paper will be white. If, however, the paper is exposed to sunlight or intense artificial light and then washed, it becomes a permanent blue. If the tracing is laid over the prepared side of the paper, in a printing frame, the light cannot penetrate the ink, and the part directly under the ink will remain unturned. If the paper is now washed, a white line on a blue background will result. Care must be taken to see that the correct side of the tracing is in contact with the coated side of the blue-print paper.

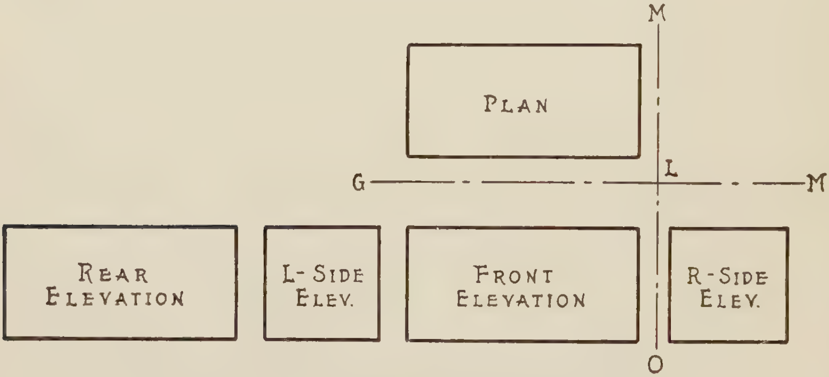


Fig. 13.—Projections of Rectangular Block Shown on One Plane.

QUESTIONS

1. Of what does a set of plans consist?

2. What information in regard to a building is given on the floor plans?

3. What information in regard to the building is given on the elevation?

4. Why is it desirable to have a competent architect design and supervise a building?

5. What information in regard to a building is given on the specifications?

6. In your city ordinances what regulations affect your work?

7. How are visible edges shown?

8. How are invisible edges shown?

9. How are dimensions shown?

10. Make a 3″ scale.

11. Secure a book of standards and compare glass sizes and window openings.

12. Study the end section of standard moldings found in a book of standards.

CHAPTER III

FRAME BUNGALOW

(Plan I)

This plan was selected because the general arrangement is more or less common in many sections of the country. The set of plans consists of thirteen sheets and with the specifications give out the information necessary for the building to be constructed by a competent contractor.

The exterior covering may be bevel siding, shingles, or other suitable covering as well as stucco. Still greater variation of exterior is secured by changes in roof construction and in the porch details.

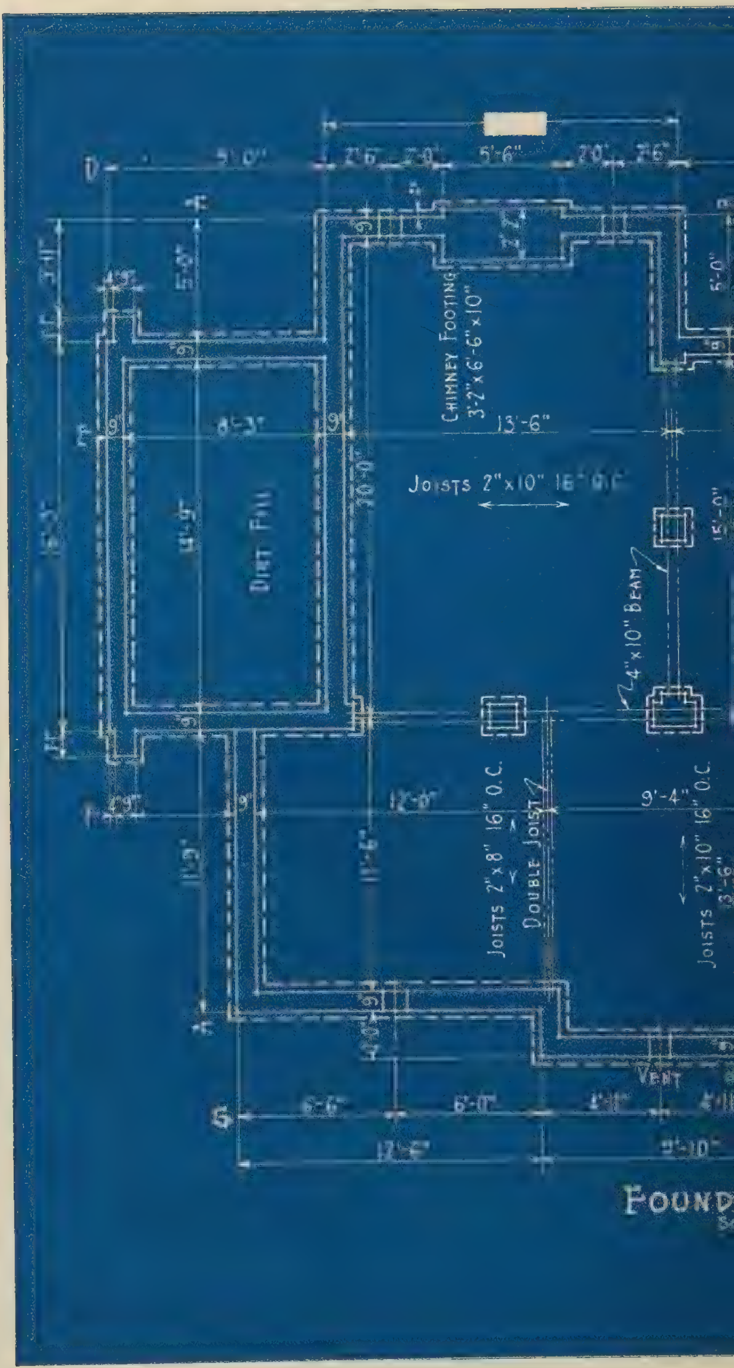
EXERCISE I

FOOTING AND FOUNDATION PLAN

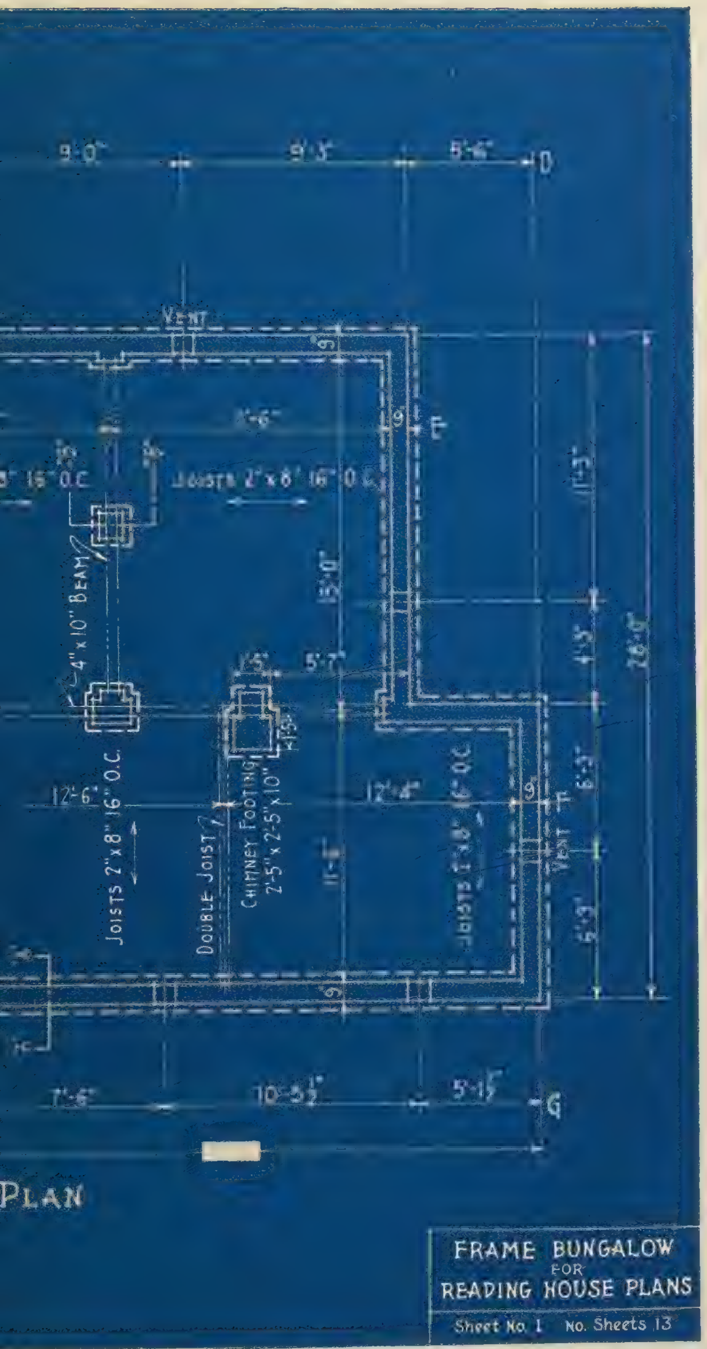
(Plan I, Sheet No. 1)

The construction of a building begins with the footings, or that part of the building upon which the foundation, piers, chimneys, etc., rest. Only on larger buildings is it customary to make separate footing plans. In buildings without basements the foundation plans show the location and horizontal sizes of the constructive parts of the footings in dotted lines; the foundation walls, piers, and other visible parts in solid lines, and indicate the locations of the constructive members used to support the first floor in dash and dotted lines or some other conventional way. Foundation plans may also show sewer, water, and gas mains, or leads.

Footings are usually made of stone, concrete, brick or other material which will not deteriorate when in contact with damp earth, and should be proportioned to the weight they will have



5'-0"
2'-6"
2'-0"
5'-6"
2'-0"
2'-6"
3'-0"
5'-0"
4'-9"
9"
8'-3"
CHIMNEY FOOTING
3'-2"x 6'-6"x 10"
13'-6"
JOISTS 2"x10" 16" O.C.
30'-0"
DIRT FILL
4"x10" BEAM
15'-0"
12'-0"
9'-4"
JOISTS 2"x 8" 16" O.C.
DOUBLE JOIST
JOISTS 2"x10" 16" O.C.
11'-6"
11'-9"
4'-0"
VENT
6'-6"
6'-0"
12'-6"
FOUND



Between pp. 22 and 23

to carry. They should be below the frost line, and their upper surface leveled to the proper horizontal plane. Observation of these rules prevents unequal settling which is the chief cause of cracks in walls.

In some cases the foundation plan also shows a detailed section through the foundation wall and footing; in others this section is shown in the details. (See Plan I, Sheet 7.) This section shows what would be seen looking at the end of the wall if the wall and footing were cut vertically at the place indicated.

Plans may show that a part or all of the space under the building is to be excavated for a basement. In such cases the wall around the basement must serve, not only as a foundation wall for the building, but as a retaining wall sufficiently strong to withstand the side thrust due to the pressure of the soil on one side only. When a variation in the size of the footings is indicated it shows that the load on the foundation wall is different at different places and the area of the footing throughout has been designed to give practically uniform bearing pressure on the soil at all points or it shows a variation in the supporting ability of the soil at that point. If the house is built on a sloping lot the question of present and future grades and the necessity of stepping down the footings to meet the requirement of firm soil and minimum depth of excavation has to be considered.

TYPE QUESTIONS

1. How many feet is provided in Plan I from the front right-hand corner of the building to the bay on the right side?
2. What is the width of this bay?
3. How far does this bay project from the main line of the building?
4. How far is the footing for the fireplace chimney from the left-hand front corner of the building?
5. How far does this chimney project beyond the wall line?
6. What is the total width of the building? Total length?
7. What is the thickness of the foundation wall?
8. What are the dimensions for the dirt fill for the front porch?
9. Take each dimension on the line *AA* and tell what it means.
10. Take the dimensions on each of the following lines and tell what each means: *BB*, *CC*, *DD*, *EE*, *FF*, *GG*.
11. Fill in all dimensions which have been omitted on the dimension lines.

12. With a colored pencil show all floor joists. The distance to be set with joist or studs is reduced to inches and divided by the distance between centers, usually 16″, to secure the number of spaces. A shorter method consists of taking $\frac{3}{4}$ of the distance (in feet) to be set, allowing in each case one extra joist for the last space or fraction of space.

EXERCISE II

FIRST-FLOOR PLAN

(PLAN I, SHEET NO. 2)

The first-floor plan furnishes information in regard to horizontal sizes of the constructive parts of the first floor, and includes the location of walls, doors, windows, plumbing and lighting equipment and built-in features.

The first-floor plan is a horizontal section through the building taken somewhere above the window sill. The walls show the relation of one room to another. The indication on these walls show the kind of windows to be used; the location and size of the doors and the way they are to swing; the location of the plumbing fixtures on this floor; the position of the lights and switches; and the built-in features are also shown for this floor.

TYPE QUESTIONS

1. Take the dimensions of each of the following lines and tell what each means: lines *AA*, *BB*, *CC*, *DD*.

2. Compare the sum of the dimensions of the line *AA* on the first-floor plan with the sum of the dimensions on the line *AA* of the foundation plan.

3. Give the distance to each partition, beginning at the rear of the house.

4. What kind of doors are shown between the dining-room and living-room? Which way do they swing?

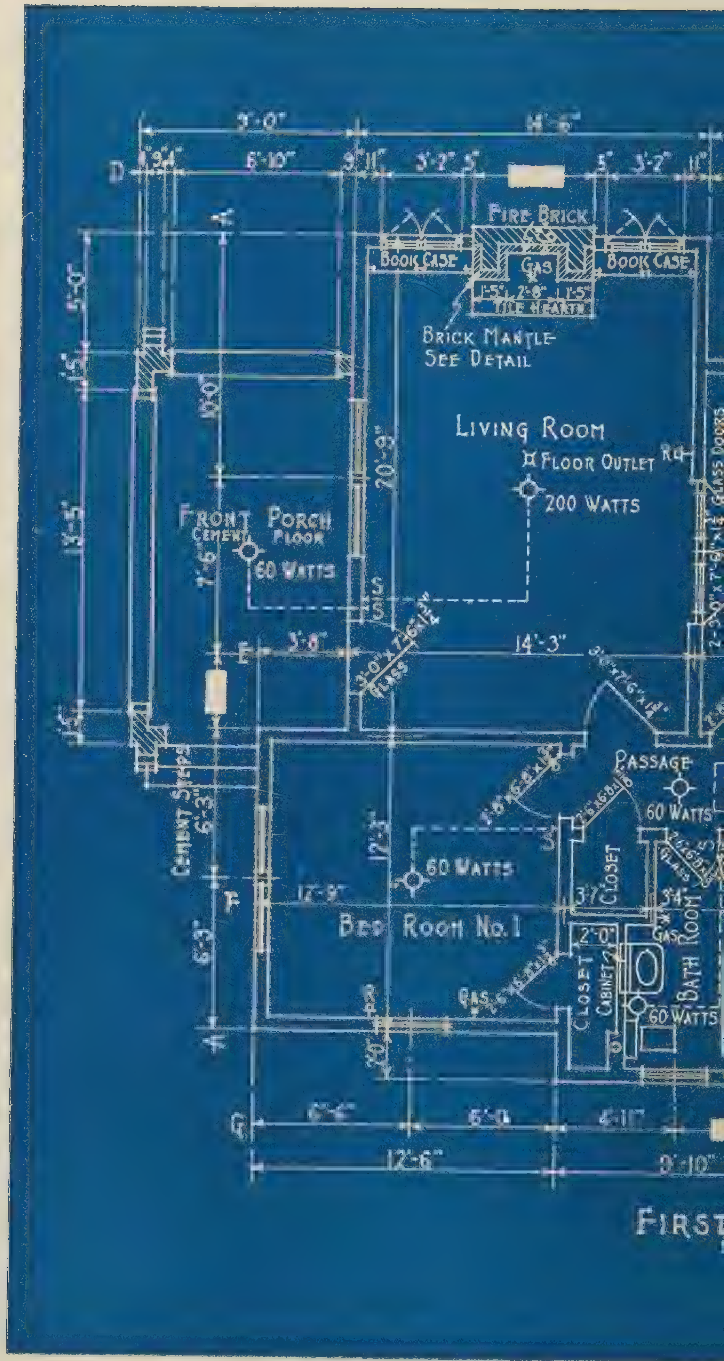
5. What is the size of the hearth?

6. How many casement windows are shown, and what width of openings is specified?

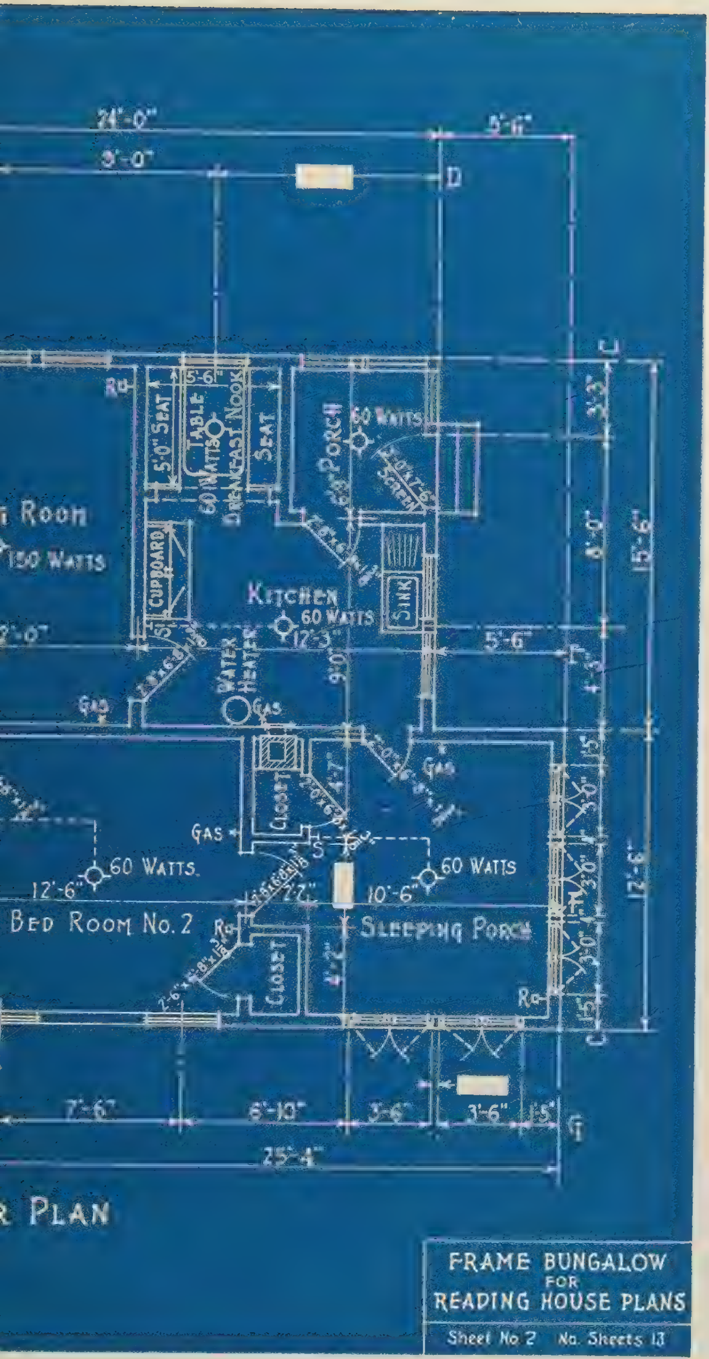
7. How wide is the passageway connecting the two bedrooms?

8. How many ceiling outlets are specified?

9. How many gas outlets are specified?



9'-0"
14'-6"
D
1'-9½"
6'-10"
9"
11"
3'-2"
5"
5"
3'-2"
11"
Fire Brick
Book Case
Gas
Book Case
1'-5"
2'-8"
1'-5"
Tile Hearth
Brick Mantle
See Detail
5'-0"
1'-5"
13'-5"
1'-5"
A
12'-0"
20'-9"
Living Room
Floor Outlet
200 Watts
2-3'-0" x 7'-6" x 1¾" Glass Doors
Front Porch
Cement Floor
60 Watts
7'-6"
S
S
E
3'-6"
3'-0" x 7'-6" x 1¾" Glass
14'-3"
3'-0" x 7'-6" x 1¾"
Passage
60 Watts
2'-6" x 6'-6" x 1¾"
2'-6" x 6'-6" x 1¾"
Closet
Cement Steps
6'-3"
12'-3"
60 Watts
17'-9"
F
3'-7"
3'-4"
Bed Room No. 1
Closet
2'-0"
Cabinet
Gas
Bath Room
60 Watts
Gas
6'-3"
2'-0"
A
G
6'-6"
6'-0"
4'-11"
12'-6"
9'-10"
First



Between pp. 24 and 25

10. What plumbing equipment is shown?

11. Fill in all dimensions which have been omitted on the dimension lines.

EXERCISE III

FRONT ELEVATION

(Plan I, Sheets No. 1, 2, 3)

The front elevation shows the proportions and arrangement of that side of the building facing the street. The horizontal dimensions are taken from the floor plans and the vertical heights are shown in the same proportion. For example, the distance *AB* is secured from the floor plan and is equal to 4″. The vertical surface which is represented by the rectangle whose base is *AB* is the 4″ projection of chimney from the ground to the cornice. The distance *BC* from the line *B* to the center of the two windows on the left is 10′ 0″. The size of the windows is given on the elevation. The size of the door is given on the floor plan. The vertical distances of the porch columns and rails are not shown on the elevation, or plan, hence a detailed drawing giving this information will likely be found somewhere in the set of plans.

TYPE QUESTIONS

1. What are the sizes of windows shown on this elevation? (Windows of this type, bungalow windows, are built so that the upper sash would occupy the same space as a sash using the same size glass as the lower sash. (See some standard mill book.)

2. What is the height of the window sill from the finished floor?

3. What kind of roof covering is used?

4. What are the distances from *A* to *B*, *B* to *C*, *C* to *D*, *D* to *E*, *E* to *F*, and *F* to *G*? Check the sum of these dimensions with the width of building.

EXERCISE IV

RIGHT-SIDE ELEVATION

(Plan I, Sheets No. 1, 2, 4)

The right-side elevation shows the proportions of the vertical surfaces on the right side of the building. The horizontal dimensions are taken from the floor plans and the vertical heights are shown in the same proportion. For example, the distance *A–B* or 6′ 6″ is found on the floor plan.. The elevation shows the window to be used is a double-sash bungalow type, corresponding glass sizes 32″ wide, 30″ high with 8 lights on upper sash and that it is to be 2′ 0″ above the floor line.

TYPE QUESTIONS

1. What is the size of the bath-room window?

2. Where is it located in regard to the front corner of the building? How high is it from the floor?

3. What is the distance of *A* to *B*, *B* to *C*, *C* to *D*, *D* to *E*, *E* to *G*?

4. How high is the sill of the window in the bay above the finished floor? How high is the sill of the casement windows above the finished floor?

5. What is the height of the sill of the hree other windows above the finished floor?

6. What is the height of the opening for the casement windows on the sleeping porch?

7. What is the distance from the finished floor line to the finished ceiling line?

8. What kind of roof covering is to be used?

EXERCISE V

REAR ELEVATION

(Plan I, Sheets No. 1, 2, 5)

Note.—The same principles as used in Exercises 3 and 4 are used in securing information from the other elevations.

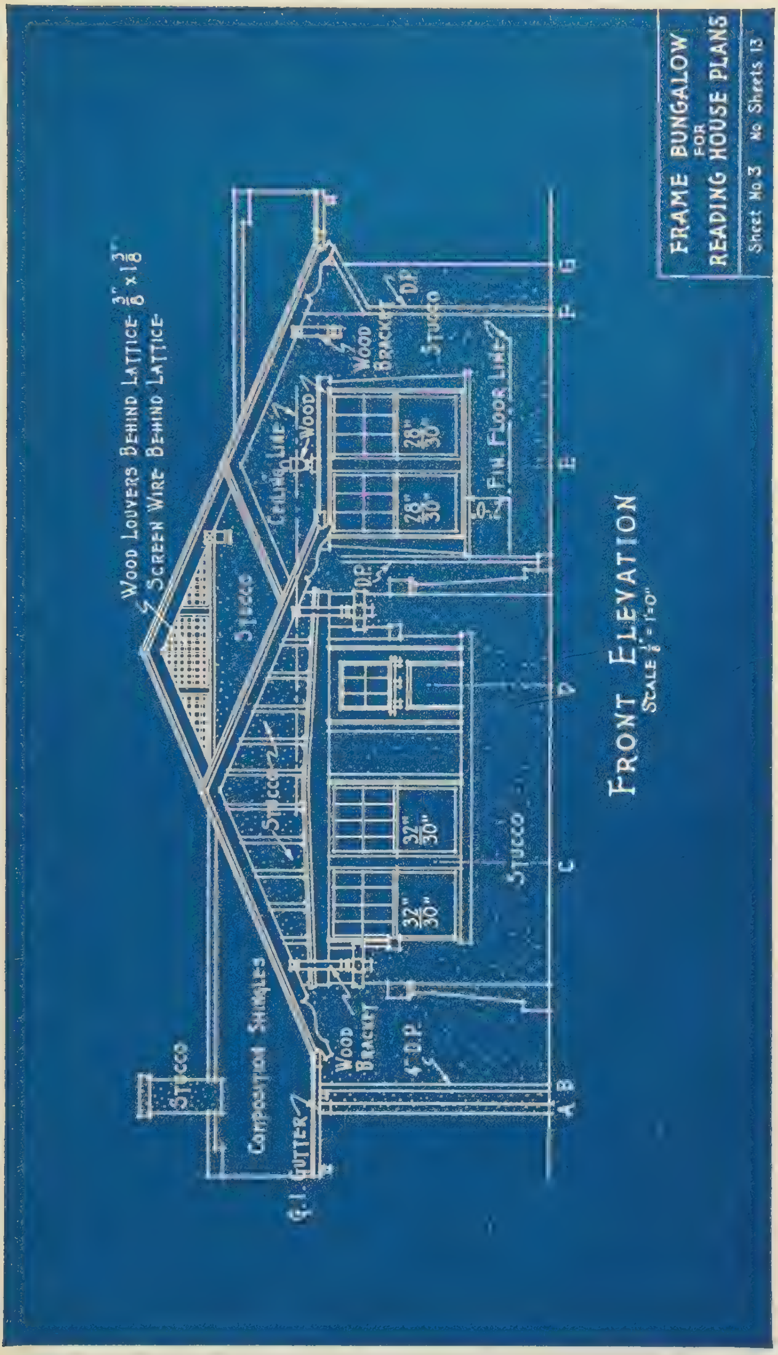
TYPE QUESTIONS

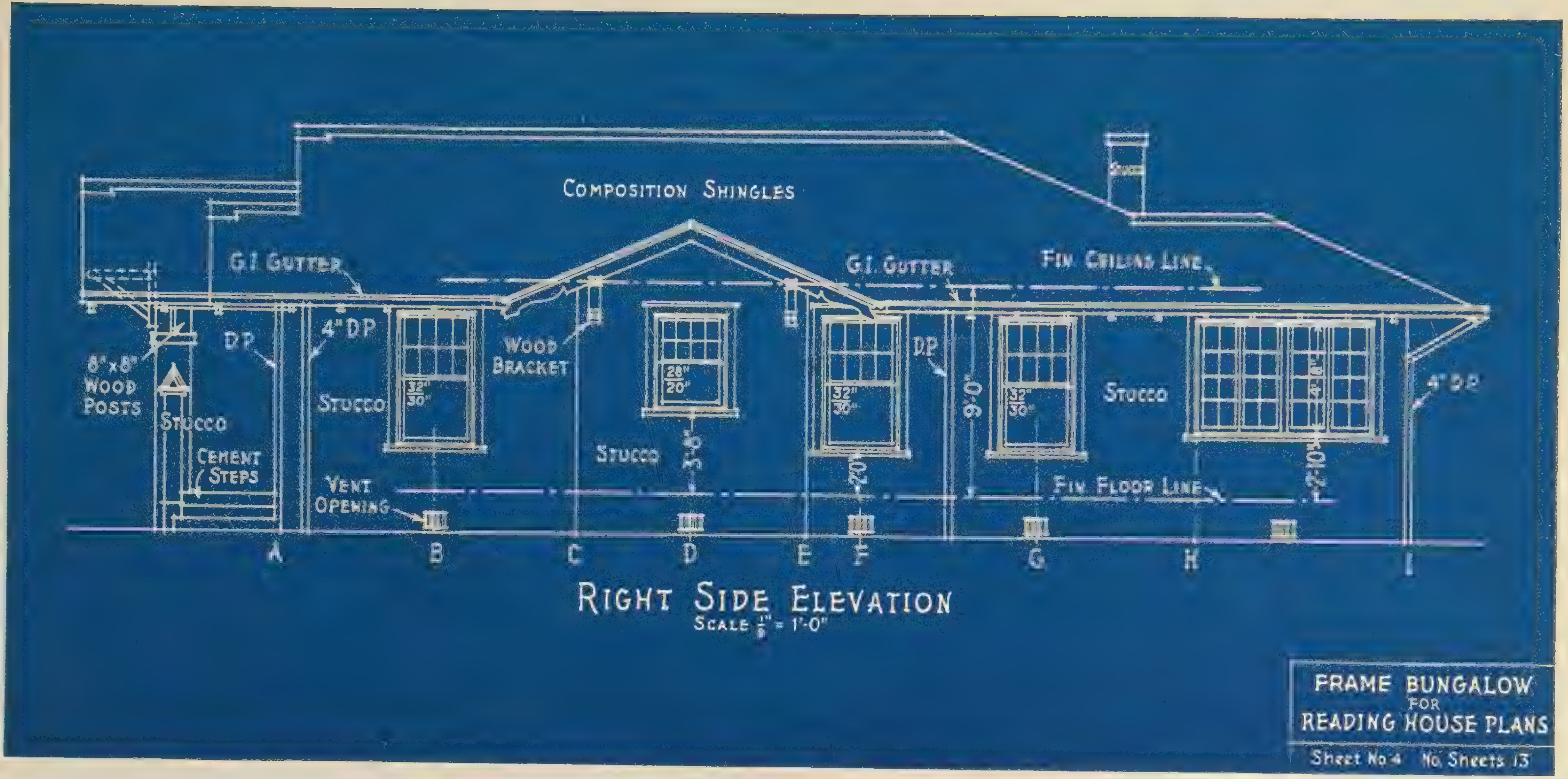
1. What are the distances *A* to *B*, *B* to *C*, *C* to *D*, *D* to *E*, and *E* to *F*?

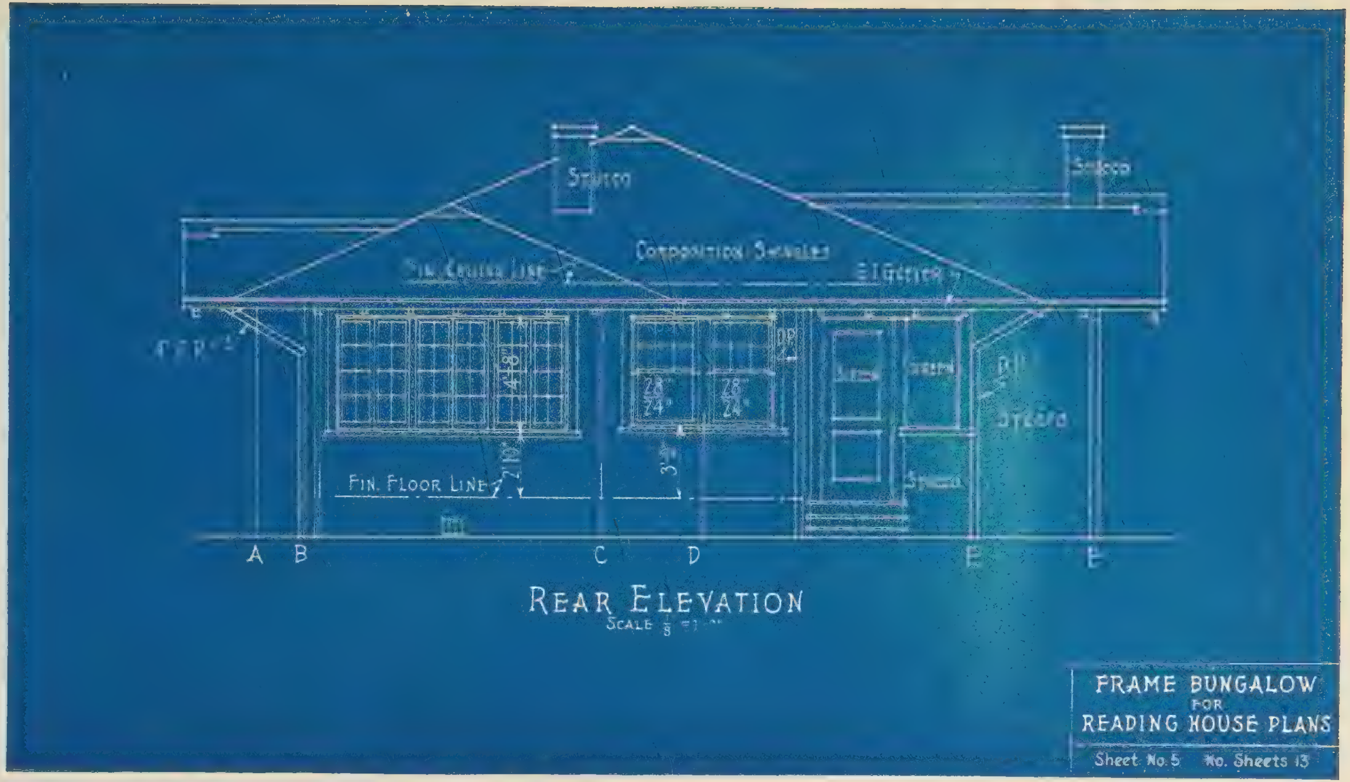
2. What are the number and sizes of the two-sash windows called for on the side?

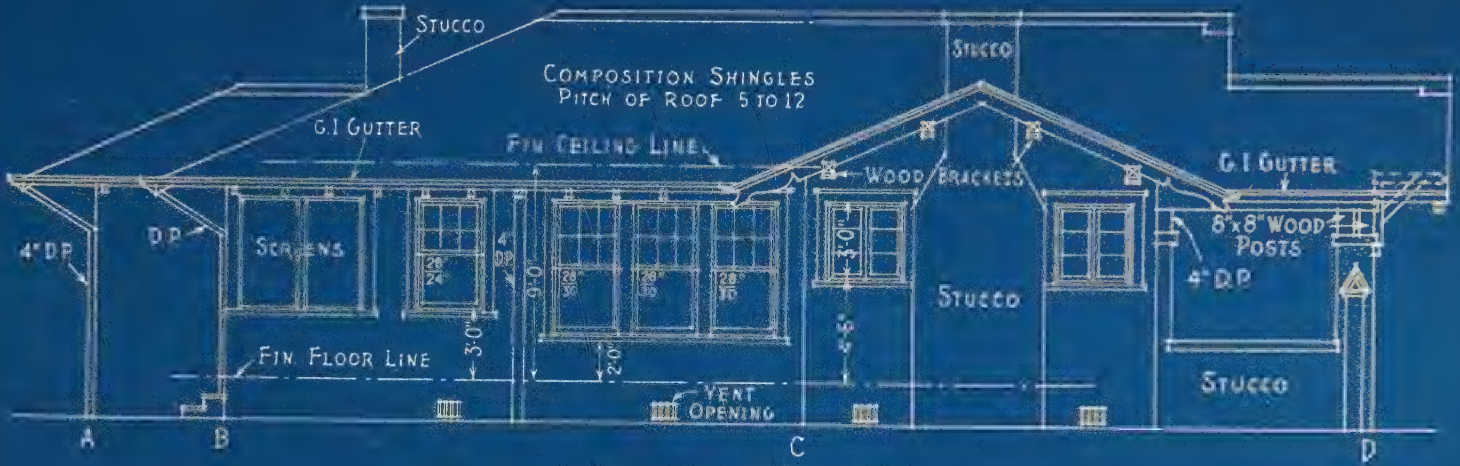
3. What is the size of the casement window? How many on this side?

4. What is the distance from the line *B* to the opening of the


WOOD LOUVERS BEHIND LATTICE 3/8" x 1 3/8"
SCREEN WIRE BEHIND LATTICE
STUCCO
COMPOSITION SHINGLES
G.I. GUTTER
WOOD BRACKET
4" D.P.
STUCCO
STUCCO
STUCCO
32"/30"
32"/30"
STUCCO
CEILING LINE
WOOD
D.P.
28"/30"
28"/30"
FIN. FLOOR LINE
WOOD BRACKET
STUCCO
D.P.
A B C D E F G
FRONT ELEVATION
SCALE 1/8" = 1'-0"
FRAME BUNGALOW
FOR
READING HOUSE PLANS
Sheet No 3 No Sheets 13


COMPOSITION SHINGLES
G.I. GUTTER
G.I. GUTTER
FIN. CEILING LINE
8"x8" WOOD POSTS
D.P.
4" D.P.
WOOD BRACKET
STUCCO
STUCCO
STUCCO
STUCCO
CEMENT STEPS
VENT OPENING
DP
4" D.P.
32"/30"
28"/20"
32"/30"
32"/30"
3'-6"
2'-0"
9'-0"
2'-10"
FIN. FLOOR LINE
A
B
C
D
E
F
G
H
I
RIGHT SIDE ELEVATION
SCALE 1/8" = 1'-0"
FRAME BUNGALOW FOR READING HOUSE PLANS
Sheet No. 4 No. Sheets 13


Stucco
Stucco
Composition Shingles
Fin. Ceiling Line
E I Gutter
4'8"
2'8"
2'4"
2'8"
2'4"
DP
2'10"
3'4"
Fin. Floor Line
Stucco
A
B
C
D
E
E
REAR ELEVATION
Scale 1/8" = 1'-0"
FRAME BUNGALOW
FOR
READING HOUSE PLANS
Sheet No. 5
No. Sheets 13



LEFT SIDE ELEVATION
SCALE 1/8" = 1'-0"

FRAME BUNGALOW
FOR
READING HOUSE PLANS

Sheet No 6 No Sheets 13

casement window? What is the distance from the line *C* to the center of the double window?

5. What is the height of the casement window sill above the floor? Of the two-sash window above the floor?

LEFT-SIDE ELEVATION

(Plan I, Sheets No. 1, 2, 6)

1. What is the distance from *A* to *B*, *B* to *C*, *C* to *D*?
2. Give the size of each window and its height from the floor line.
3. What is the slope of the roof? How does this differ from pitch?

EXERCISE VI

FRAMING OR CONSTRUCTION DETAILS

(Plan I, Sheet No. 7)

Construction details are sections through some part of the building. They show how the building would look if cut along the line (plane) at which the section is made. They show the methods and material of construction, the manner in which the material is to be assembled, and other information in regard to the construction of the building which cannot be shown on the plans and elevations. Pieces which would be cut by the plane are usually sectioned according to the standards shown in Fig. 1, page 4.

If the design includes two or more floors additional details are shown. They show how the second floor with its room partitions is to be supported, also some means of going from floor to floor. A knowledge of the strength of materials and the forces acting in a building has resulted in the practical standardizing of wall construction.

In two-story residence construction the size of floor joists of a given span (length) have become practically standardized for uniform floor loads. When the partitions are not in a vertical plane, that is, when those on the second floor are not directly above those on the first floor, the builder must consider not only the uniform load which the floor is to carry but a concentrated load at the partition of the second floor due to its own weight and what it must support. This load must be carried by the framing to the footings. If this load is parallel to the floor joists it may be carried to the vertical wall by increasing the number of joists at that point. If it is at right angles to the floor joists all joists must be designed to carry the load without danger of breaking or excessive deflection or bending.

TYPE QUESTIONS

1. What is the size of the footing under the exterior wall? How far below grade is it necessary to excavate for the footing?
2. To what class of sill does the sill used belong? Why? What other types of sills do you know which belong in the same class?
3. What is the size of the bed plate? Floor joists? What size studs are used? What is the distance o.c. for each? (o.c. is read "on center.")
4. What exterior covering is used? See page 49. What would be the difference in construction if beveled siding were used instead of stucco?
5. What class of cornice is used? What is the overhang? What is the size of the rafters? What is their distance o.c.?
6. What is the size of the ceiling joists? What is their distance o.c.?
7. What is the width and height of the framed opening necessary for the front door? For the front window? For one of the casement windows?
8. With a colored pencil show exterior framing on all elevations.

EXERCISE VII

PORCH CONSTRUCTION

(PLAN I, SHEET NO. 8)

Reference also to Sheets No. 1, 2, 3, 4

TYPE QUESTIONS

1. How many 8″ × 8″ wood posts are used? (Study the floor plan to determine the shape of the column.)
2. How long is the truss over the porch? What has the architect assumed, when he shows only the one section through the gable, in regard to the builder's knowledge of truss construction?

3. Make a sketch free hand showing the construction of the truss. What size ceiling joists are used for the porch? How is the ceiling to be finished?

EXERCISE VIII

MILL DETAILS

(PLAN I, SHEETS NO. 9, 10, 11, 12)

Mill details include drawings which show the shape or section of the various moldings used throughout the building, unless the same are standard and designated by name and number on the plan or elevation. It also furnishes information which is needed by the mill man to make the door frames, casings, window frames, baseboards, moldings, mantels, cornices, built-in cabinets, in fact, all work which has to be or can be done at the mill and sent to the building ready to assemble. The man on the building must know something of mill details and standard mill work in his community and do the framing according to these details and standards, or the mill work will not fit correctly when received on the job.

In many sections stair work has become a specialized form of mill work with the carpenter framing only the stair well or rough opening for the finished stairs. A detailed study of stair construction is a course in itself, but some general principles can be given here.

The straight stair forms the basis for study of all stair construction—the riser (Fig. 14) shows the vertical distance of a step, the tread (Fig. 14) shows the horizontal distance of a step or the distance from one riser to the next—the width of a step is the tread plus the nosing. The number of risers times the rise gives the distance from floor to floor. The number of treads (one less than the number of risers) times the tread gives the horizontal distance or run of the stairs. In residence work stairs from first to second floor generally have a rise of 7″ to 7¼″ with a tread from 10½″ to 10″. In stairs with landings the landing takes the place of a tread. In laying out stairs the distance from floor to floor is taken and spaced into the required number of risers. If the exact dimension of the tread is not given the run is taken and spaced for the treads in the same way, allowance being made for landings if shown.

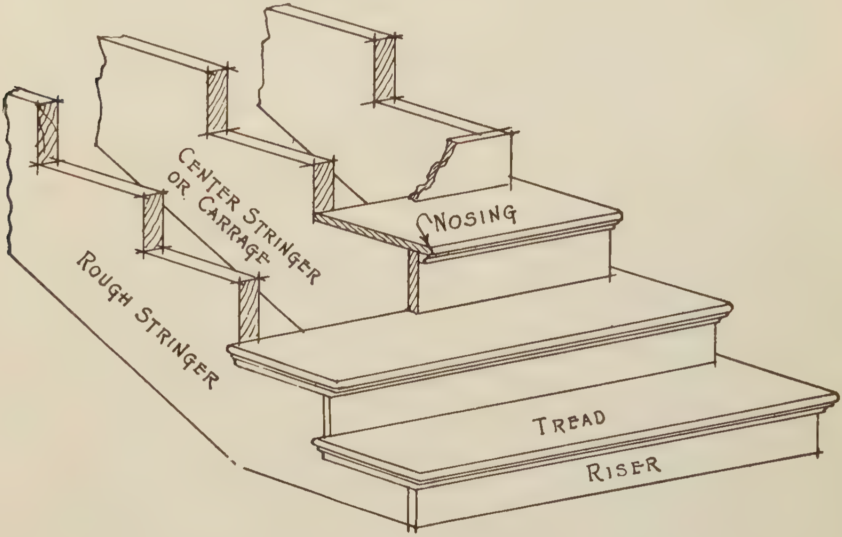


Fig. 14.—Stair Detail.

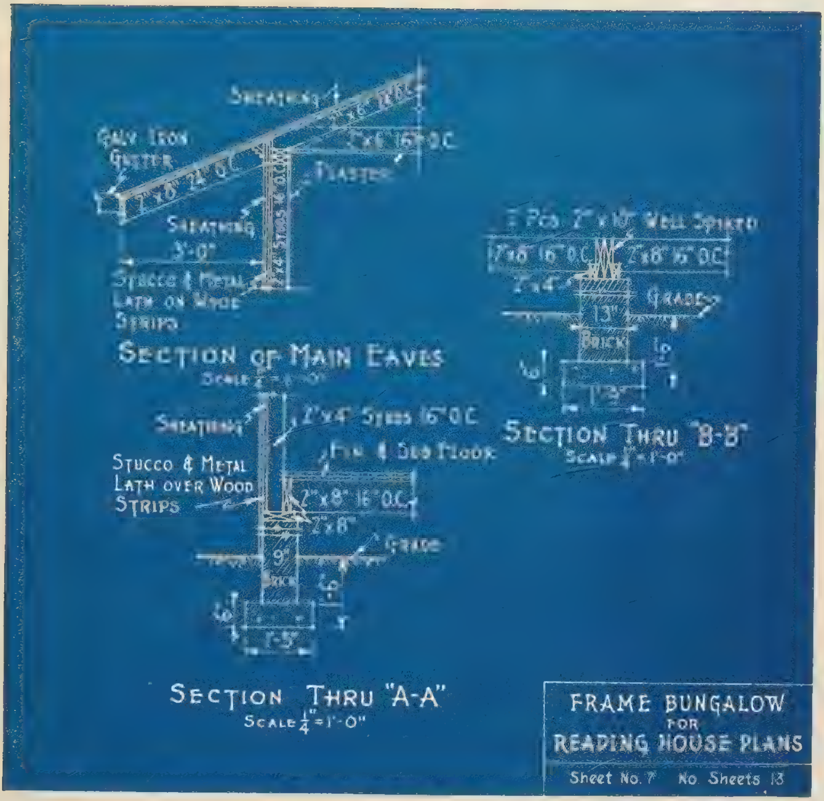
TYPE QUESTIONS

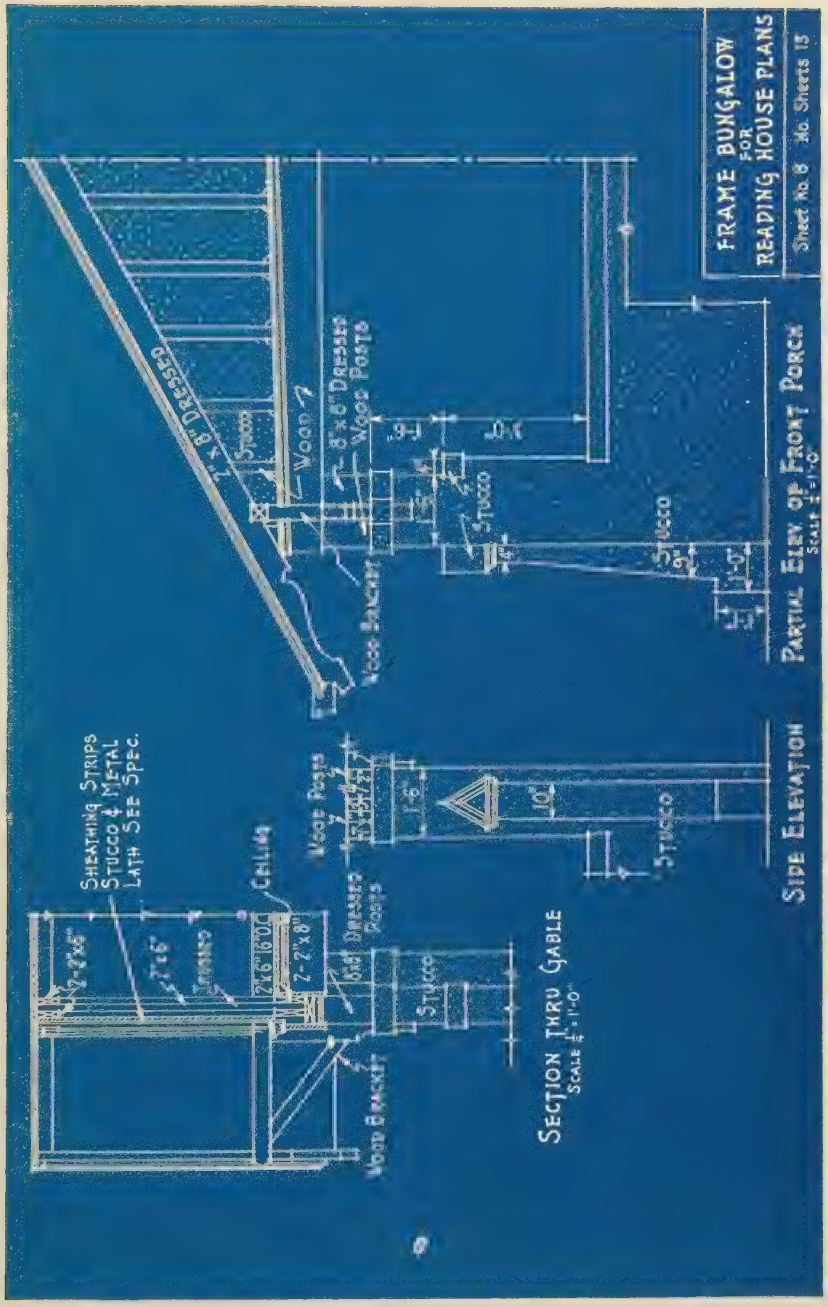
1. Is the casing to be used standard as given in a standard or universal design book? If so, give the catalog number. Do the same for the baseboard shoe, and cap; for the cornice in the living-room and dining-room; the picture molding. (Sheets No. 9–13.)

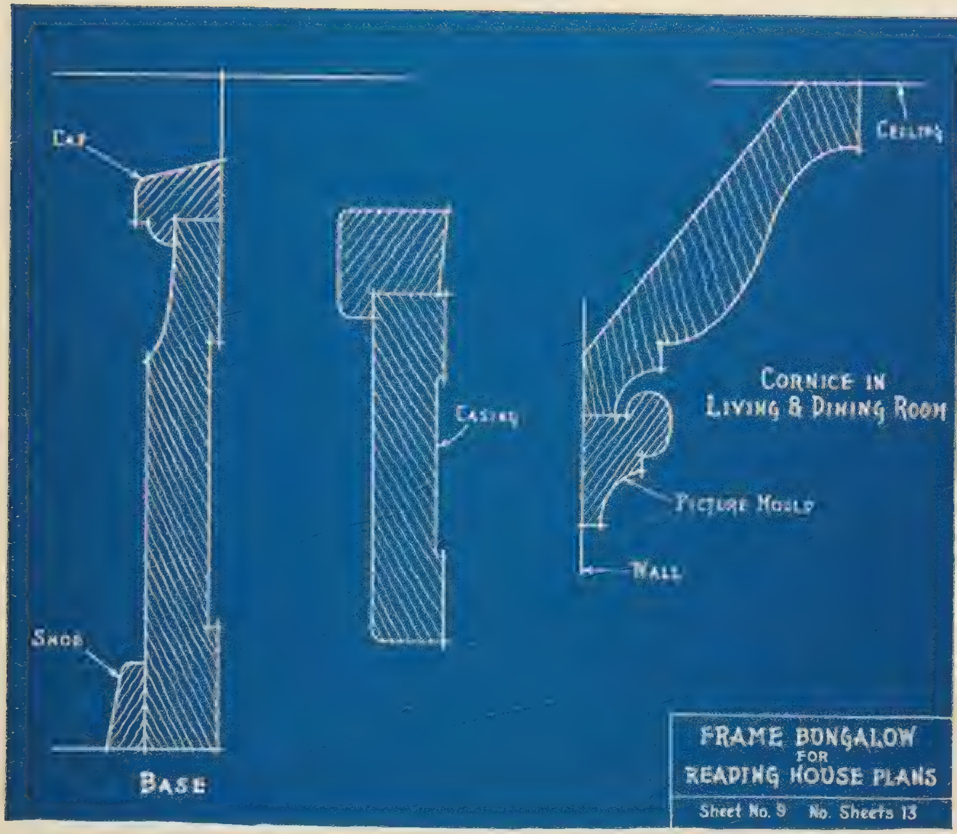
2. What style doors are specified on the kitchen cupboard? Give the dimensions of each door. What is the total height of this cupboard? What is the total depth of the upper section? Of the lower section? Can you determine the inside measurement for the drawers? What moldings would you select? (Sheet No. 10).

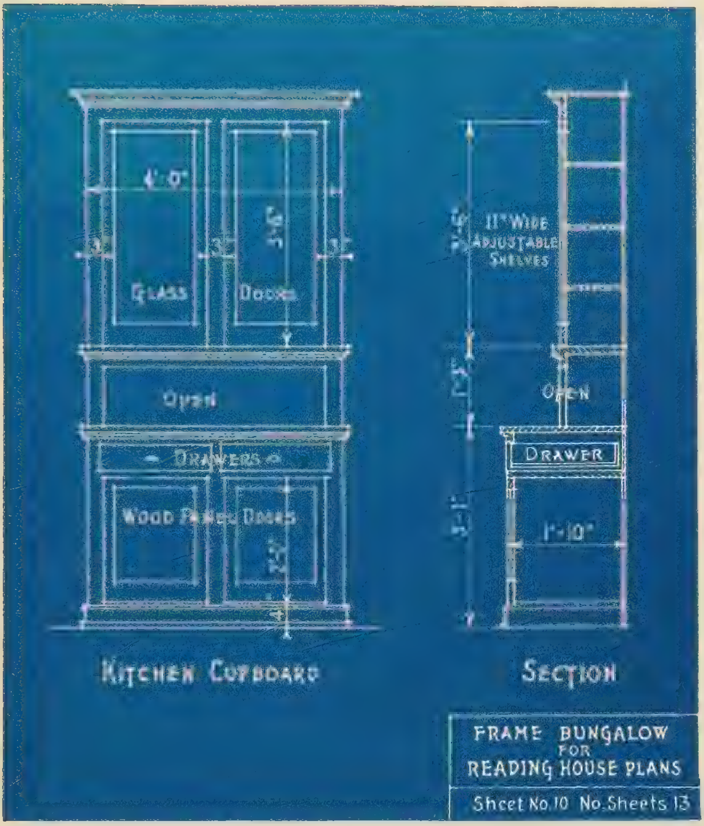
3. What is the height of the table in the breakfast nook? Its width? Its length? What would be the height and depth of the seat? Its length? What is the height and width of the French doors? (See first-floor plan. (Sheet No. 11.)

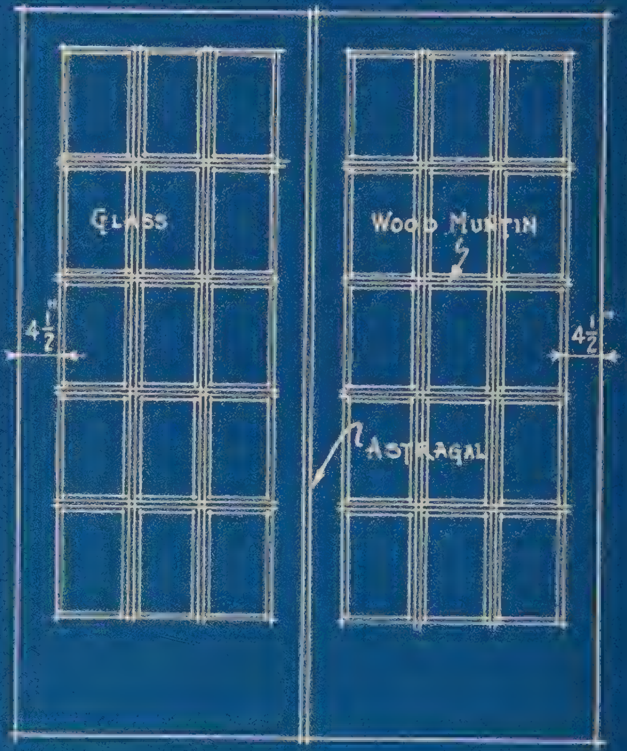
4. What is the height of the mantel? What is the depth of the book case? What is the size of the grate opening? What kind of shelves are specified in this book case? How high would the wood base be for the book case?


Sheathing
2"x6" 24" O.C.
Galv. Iron Gutter
2"x6" 16" O.C.
2"x6" 24" O.C.
Plaster
Sheathing
2"x4" Studs 16" O.C.
3'-0"
Stucco & Metal Lath on Wood Strips
Section of Main Eaves
Scale ¼"=1'-0"
3 Pcs. 2"x10" Well Spiked
2"x8" 16" O.C.
2"x8" 16" O.C.
2"x4"
Grade
13"
Brick
6"
1'-9"
Section Thru "B-B"
Scale ¼"=1'-0"
Sheathing
2"x4" Studs 16" O.C.
Fin. & Sub Floor
Stucco & Metal Lath over Wood Strips
2"x8" 16" O.C.
2"x8"
Grade
9"
Brick
6"
1'-5"
Section Thru "A-A"
Scale ¼"=1'-0"
FRAME BUNGALOW
FOR
READING HOUSE PLANS
Sheet No. 7 No. Sheets 13

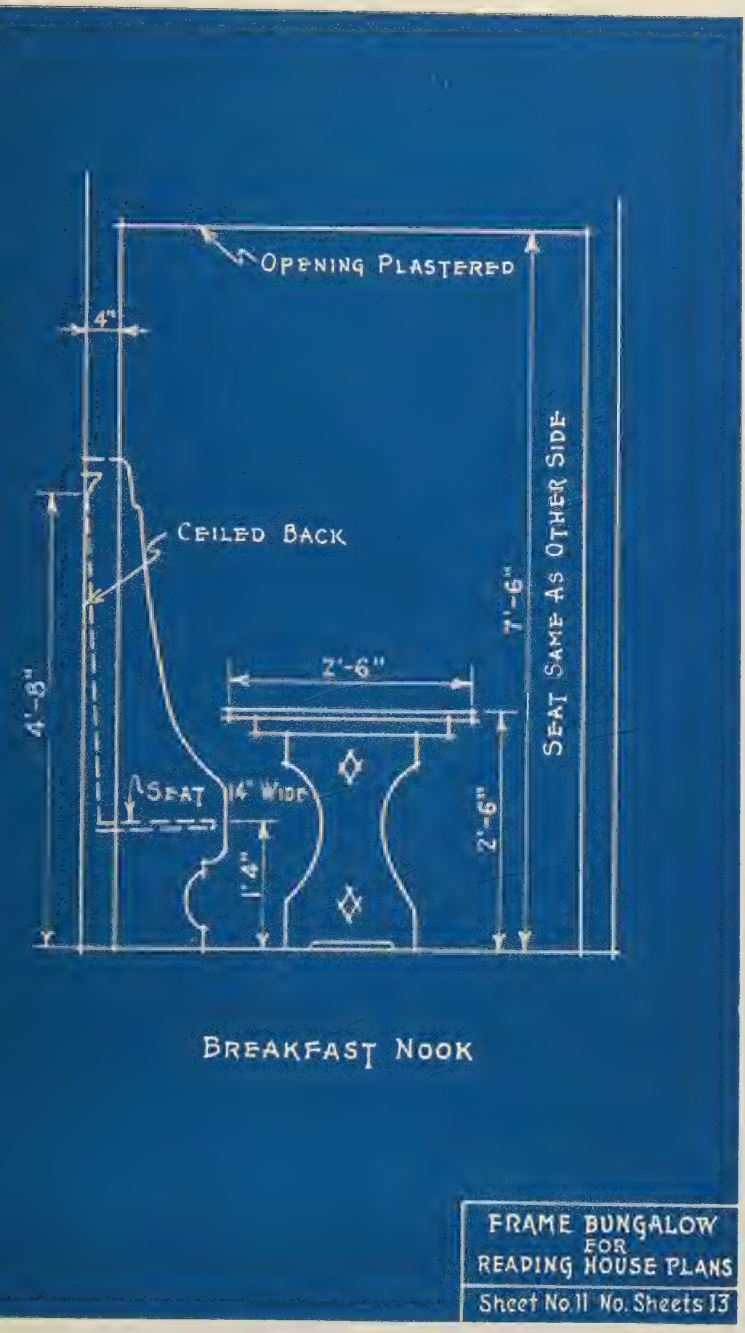

FRAME BUNGALOW
FOR
READING HOUSE PLANS
Sheet No. 8 No. Sheets 15
PARTIAL ELEV OF FRONT PORCH
SCALE 1/4"=1'-0"
SIDE ELEVATION
SECTION THRU GABLE
SCALE 1/4"=1'-0"
SHEATHING STRIPS
STUCCO & METAL
LATH SEE SPEC.
2-2"x6"
2"x6"
TRIMMED
2"x6" 16"O.C.
2-2"x8"
CEILING
8x8" DRESSED POSTS
WOOD POSTS
WOOD BRACKET
STUCCO
2"x8" DRESSED
WOOD
8"x8" DRESSED WOOD POSTS
1'-6"
1'-0"
9"
10"


Cap
Shoe
Base
Casing
Ceiling
Cornice in Living & Dining Room
Picture Mould
Wall
FRAME BUNGALOW FOR READING HOUSE PLANS
Sheet No. 9 No. Sheets 13

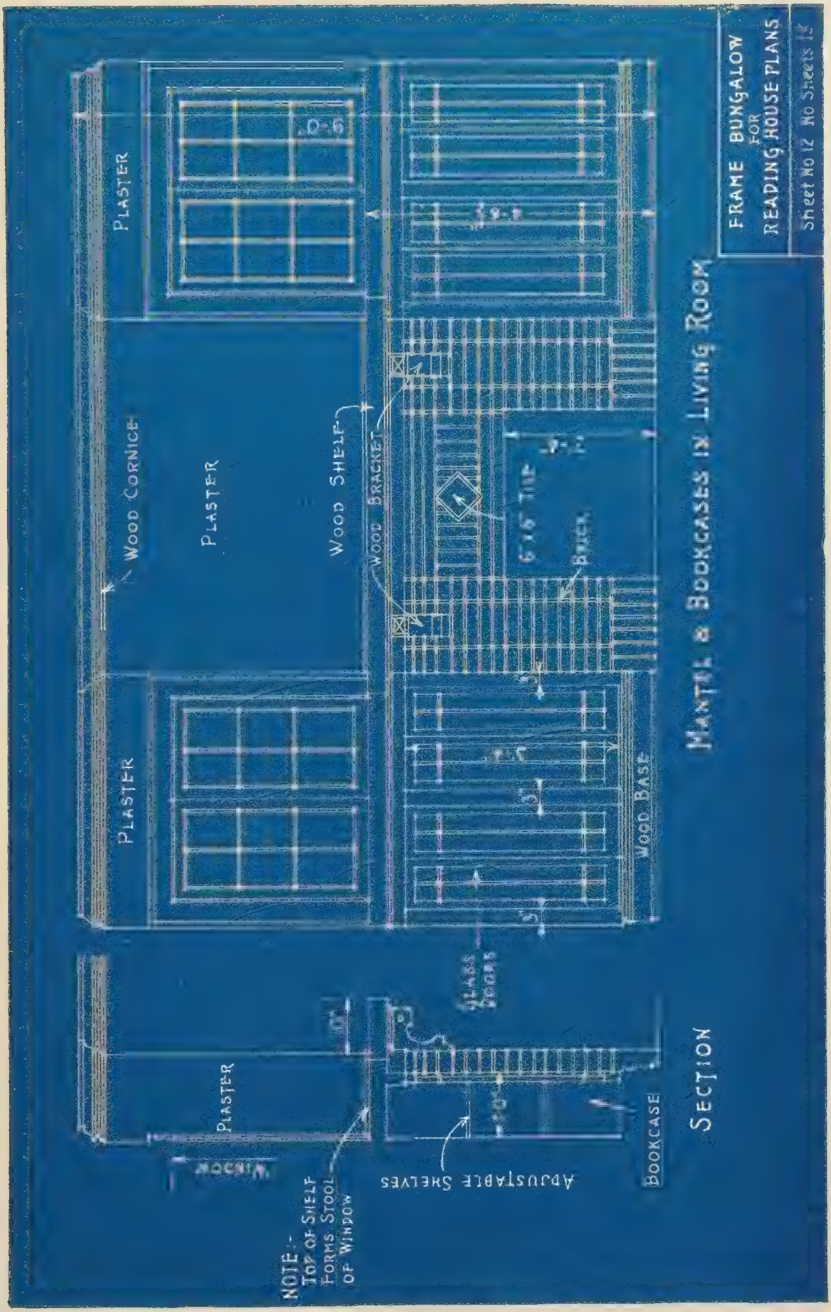

4'-0"
3'-6"
3"
3"
3"
GLASS DOORS
OPEN
DRAWERS
WOOD PANEL DOORS
2'-3"
4"
KITCHEN CUPBOARD
3'-6"
11" WIDE ADJUSTABLE SHELVES
1'-3"
OPEN
DRAWER
3'-1"
1'-10"
SECTION
FRAME BUNGALOW FOR READING HOUSE PLANS
Sheet No.10 No.Sheets 13

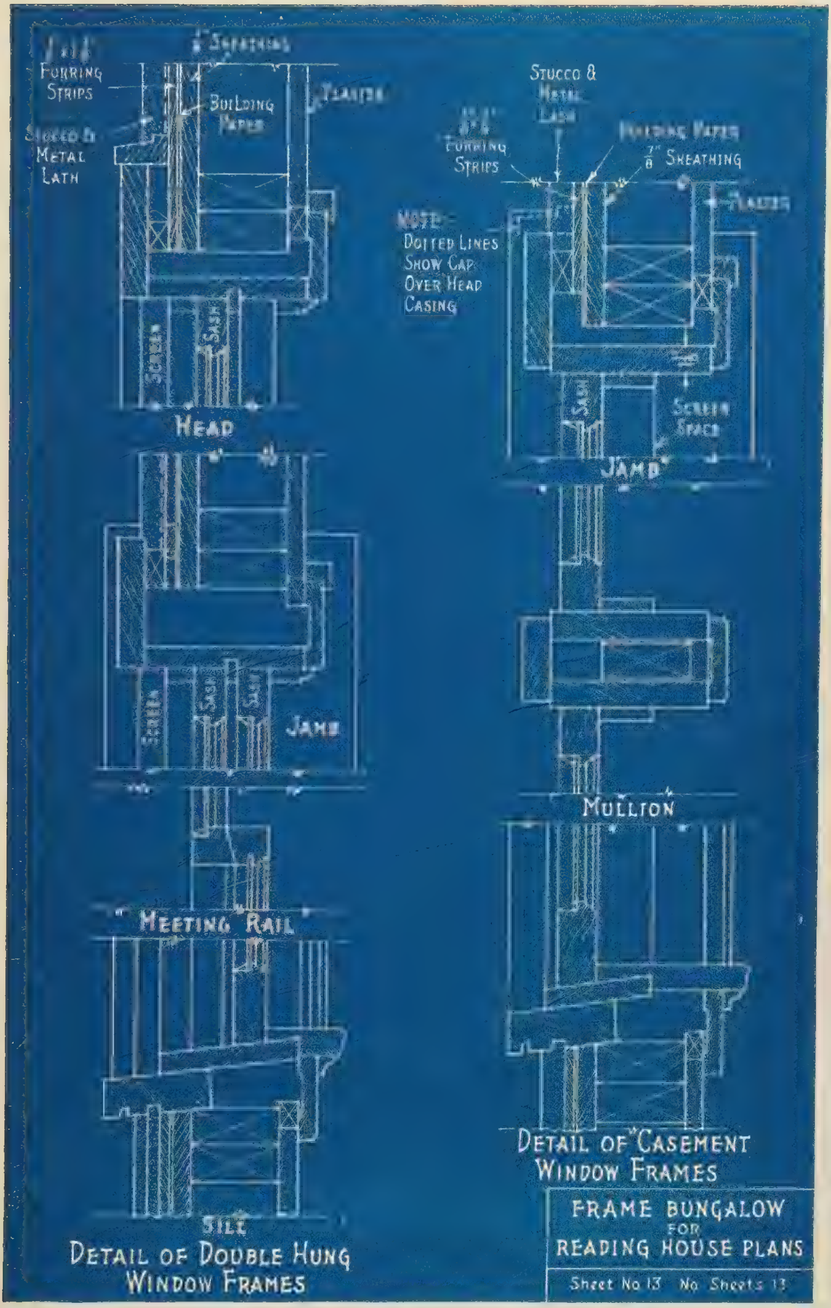


FRENCH DOORS TO DINING ROOM
SCALE ½" = 1'-0"


OPENING PLASTERED
4"
CEILED BACK
4'-8"
7'-6"
SEAT SAME AS OTHER SIDE
2'-6"
SEAT
14" WIDE
1'-4"
2'-6"
BREAKFAST NOOK
FRAME BUNGALOW
FOR
READING HOUSE PLANS
Sheet No.11 No. Sheets 13

To face p. 46


FRAME BUNGALOW
FOR
READING HOUSE PLANS
Sheet No 12 No Sheets 13
MANTEL & BOOKCASES IN LIVING ROOM
PLASTER
9'-0"
WOOD CORNICE
PLASTER
WOOD SHELF
WOOD BRACKET
4'-6"
6"x6" TILE
BRICK
2'-6"
PLASTER
3"
3"
5"
WOOD BASE
GLASS DOORS
SECTION
PLASTER
10"
WINDOW
NOTE:-
TOP OF SHELF
FORMS STOOL
OF WINDOW
ADJUSTABLE SHELVES
BOOKCASE


Furring Strips
Sheathing
Building Paper
Plaster
Stucco & Metal Lath
Screen
Sash
Head
Screen
Sash
Sash
Jamb
Meeting Rail
Sill
Detail of Double Hung Window Frames
Stucco & Metal Lath
Furring Strips
Building Paper
7/8" Sheathing
Plaster
Note:
Dotted Lines Show Cap Over Head Casing
Sash
Screen Space
Jamb
Mullion
Detail of Casement Window Frames
Frame Bungalow for Reading House Plans
Sheet No 13 No Sheets 13

EXERCISE IX

EXCAVATION AND FILLS

(Plan I, Sheets No. 1 to 7.)

Excavations are figured by the number of cubic feet or cubic yards of earth which has to be removed. Dirt fills are figured the same way.

TYPE QUESTIONS

1. What is the area of a cross-section of the trench which will have to be excavated for the footing for the 9″ wall?
2. What is the total length of this trench?
3. How many cubic feet of earth would have to be removed in digging the trench?
4. What is the area of excavation for each pier footing? For each chimney footing?
5. How many cubic feet of earth are removed for pier and chimney footings?
6. How many cubic feet of earth have to be excavated? Will this be sufficient to fill the space under the porch?
7. Make a quantity survey using the following outline.

Excavation for

Wall footings........................... cu. ft.
Chimney footings........................ " "
Pier footings........................... " "
Total.................................. cu. ft.

Fills—Total............................ " "
Surplus or deficit....................... ( )

EXERCISE X

CONCRETE

(Plan I, Sheets No. 1 to 7)

Concrete consists of a mixture of Portland cement, sand (fine aggregate), and crushed rock (coarse aggregate) in varying proportions. For foundations, a 1 : 2 : 4 mixture consisting of 1 cu. ft. of Portland cement (1 bag), 2 cu. ft. of sand, and 4 cu. ft. of crushed rock, 1½″ aggregate, is often used. When mixed, this amount of material will give 4½ cu. ft. of concrete. Care must be used in selecting aggregate and in mixing. There are several proportions which have the same strength depending upon the size of aggregate. A 1 : 2 : 3 mix with the fine aggregate from 0–4 and the coarse from 4 to 1¼″ is frequent in road work. The strength of concrete mixture is dependent to a large extent upon the ratio of water to cement. The smallest amount of water that can be used to produce a workable consistency the stronger the cement. Data can be secured from the Portland Cement Association on cement and concrete mixtures.

TYPE QUESTIONS

1. How many lineal feet of concrete footing 1′– 5″ wide and 6″ thick is needed? (Wall footing.)
2. How many cubic feet of concrete will be needed for the concrete footing for the walls?
3. How many cubic feet of concrete required for the pier footings? The chimney footing?
4. How many cubic feet of concrete required for all footings?
5. How many cubic feet of cement, sand and aggregate must be ordered for footings? Use the following form for quantity survey.

Concrete:

Wall footings.		cu. ft.
Chimney footings.		" "
Pier footings.		" "
Total.		cu. yds.

Cement.		bags
Sand.		yds.
Crushed rock.		"

EXERCISE XI

BRICK WORK

(PLAN I, SHEETS NO. 1, 2, 3, 4, 5, 6, 12)

The American Society for Testing Materials adopted as a standard dimension for brick the size 8″ × $3\frac{3}{4}$″ × $2\frac{1}{4}$″. This is also the standard size of the American Face Brick Association, for rough brick, and of the Common Brick Manufacturers' Association of America. These dimensions, however, vary with different manufacturers due to locality, kind of clay, kiln burning, and machinery. As this variation runs as high as 10 per cent the contractor must always ascertain the exact size of the brick specified and take into consideration the thickness of the mortar joint.

In brick work the general unit of measurement is 1000 brick laid in the wall, 5 per cent extra being ordered for breakage. In determining the number of brick in a wall the surface area of the wall and size of brick in the locality are used. For each square foot of surface 4″ in thickness, *i.e.*, 1 brick thick, 7 brick are used. For a 9″ wall, a wall 2 brick thick, 14 brick are used In general, estimaters figure 7 brick per square foot for each 4″ of thickness. These figures are for standard brick laid with $\frac{1}{4}$″ joint and running bond.

Where it is necessary to secure the number of brick per square foot of surface for each 4″ of thickness any size brick and joint proceed as follows:

Step (1). Find the average size of the brick to be used and add the thickness of the mortar joint to the length and thickness of the brick.

Step (2). Multiply the result together to give the area in square inches of one brick with its joint.

Step (3) Divide 144, the number of square inches in 1 sq. ft., by the result in Step (2) which gives the unit number of brick per square foot for each 4″ of thickness with running bond.

In practice the correct spacing and unit to be used are determined on the job. The mason or contractor lay up a few brick and space the joint so that the wall will lay up correctly to the required dimensions and show a uniform joint. At the same time the joint used must correspond to that specified. When face brick with bonds using headers are employed an allowance must be added to the number of brick figured for running bond. The number of common backing brick being correspondingly less.

Mortars. Mortar mixtures consist of varying proportions of lime or cement or both mixed with sand.

A lime mortar consisting of 1 part of lime and 3 of sand is known as a 1 : 3 mix. Other proportions are also used. Cement mortars vary in their proportion of cement and sand depending upon nature of work, a 1 : 3 cement mortar mixed with the smallest amount of water that can be used and at the same time produce a good workable mixture is often specified where strength is important. Cement mortars vary in these proportions from 1 : 1 to 1 : 6.

Cement lime mortars are generally made by adding lime paste or hydrated lime to cement mortars. As high as 20 per cent lime can be added without much change in the strength of the mortar. Lime added to cement mortar makes it more plastic and easier to work. For certain kinds of brick work a 1 : 1 : 6 mix is to be used.

The amount of mortar required per 1000 brick depends upon the thickness of the joint and the thickness of the wall. A ½″ joint requires twice as much mortar as a ¼″ joint. A wall 9″ in thickness requires approximately $\frac{3}{10}$ more mortar per 1000 brick than a 4″ wall.

The three following tables used by permission of the American Face Brick Association, Chicago, will be of value in making material surveys for brick work.

TABLE I

Standard Size Face Brick per Square Foot

Joint	⅛″	¼″	⅜″	½″	⅝″	¾″	1″
Number of brick	7½	7	6½	6⅛	5¾	5½	5

TABLE II

Percentages Added for Various Bonds

Common (header course every 5th course)	20%	($\frac{1}{5}$)
Common (header course every 6th course)	$16\frac{2}{3}$%	($\frac{1}{6}$)
Common (header course every 7th course)	$14\frac{1}{3}$%	($\frac{1}{7}$)
English or English Cross (full headers every 6th course)	$16\frac{2}{3}$%	($\frac{1}{6}$)
Flemish (full headers every 5th course)	$6\frac{2}{3}$%	($\frac{1}{15}$)
Flemish (full headers every 6th course)	$5\frac{2}{3}$%	($\frac{1}{18}$)
Two-stretcher Garden Wall (full headers every 5th course)	4%	($\frac{1}{25}$)
Three-stretcher Garden Wall (full headers every 5th course	$2\frac{7}{8}$%	($\frac{1}{35}$)
Double Headers (alternating with stretcher every 5th course)	10%	($\frac{1}{10}$)
Double Headers (alternating with stretcher every 6th course)	$8\frac{1}{3}$%	($\frac{1}{12}$)

TABLE III

Estimating Quantities of Material for Various Mortars

(Quantities Based on Laying 1000 Brick with ½″ Joints)

Proportions	4″ Wall				8″ Wall				12″ Wall			
	Cement, Sacks	Lime, Lump or Hydrated		Sand, Cu. Yds.	Cement, Sacks	Lime, Lump or Hydrated		Sand, Cu. Yds.	Cement, Sacks	Lime, Lump or Hydrated		Sand, Cu. Yds.
		Bbls.	Sacks			Bbls.	Sacks			Bbls.	Sacks	
Cement Mortars												
Cement, 1 : Sand, 2	3.90	.....	.....	.43	5.00	.....	.....	.55	5.40	.....	.....	.60
Cement, 1 : Sand, 2½	3.30	.....	.....	.43	4.20	.....	.....	.55	4.40	.....	.....	.60
Cement, 1 : Sand, 3	2.90	.....	.....	.43	3.70	.....	.....	.55	4.00	.....	.....	.60
Lime Mortars												
Lime, 1 : Sand, 2	.....	.75	3.00	.43	.....	.96	3.80	.55	.....	1.00	4.20	.60
Lime, 1 : Sand, 2½	.....	.65	2.60	.43	.....	.82	3.30	.55	.....	.90	3.60	.60
Lime, 1 : Sand, 3	.....	.54	2.20	.43	.....	.69	2.70	.55	.....	.70	3.00	.60
Cement-Lime Mortar												
Cement, 1 Lime, 1 } : Sand, 6	1.75	.43	1.75	.43	2.20	.55	2.20	.55	2.40	.60	2.40	.60

TYPE QUESTIONS

1. Assuming that the foundation wall extends 2′ above grade, what is the total height of the brick wall? How many brick thick is it? What is its standard width?

2. What is the total length of the 9″ wall?

3. How many square feet of surface are there in the 9″ wall? How many brick will it take to lay this wall running bond?

4. How many brick required for each square pier? Each T-shaped pier?
5. How many brick will have to be ordered for the foundation wall and piers?
6. How many yards of sand will have to be ordered for the foundation?
7. Make bill of material covering all brick work.

The following procedure is suggested for making a quantity estimate for brick work.

Foundation:

Square feet of surface........................
Face brick required..........................
Add for bond..................................
Add for waste.................................
Deduct for openings..........................

Total to order................................

EXERCISE XII

ELECTRIC WIRING

(Plan I, Sheets No. 1, 2, 3, 4, 7)

Drawings for smaller buildings show only the position of outlets, or the position of the outlet with an indication as to the corresponding switch. The Fire Underwriters, regulations and local code determines the requirements for their installation.

TYPE QUESTIONS

1. How many ceiling outlets are shown? What size lights are specified? How many floor outlets? How many wall outlets?
2. How many switches are shown? What kind are to be installed?
3. Where is the current to enter the building? What is the total power consumption indicated? What size of wire is to be used?
4. With colored pencil draw lines on the blue print showing complete wiring plan, noting the distance of the rise (vertical distance) where the wire runs vertically. Make an estimate of total number of feet of wire required.
5. Determine the character of wiring (knob and tube, or conduit) and the amount of material necessary to do the job.

EXERCISE XIII

PLUMBING

(Plan I, Sheets No. 1, 2, 3, 4, 7)

Drawings for small buildings often show only the plumbing fixtures. Specifications and city ordinances take care of the other necessary details. When an extra sheet showing plumbing layout is not included in a set of plans, the contractor usually makes colored pencil sketches on the plans.

A line in one color shows the soil, waste, and vent lines; a second color shows the cold-water lines; and a third shows the hot-water lines. Figures and notes indicate the size, length, or angle, and oblique or slanting lines on the plan are used to indicate the vertical lines and are marked riser or drop.

TYPE QUESTIONS

1. What plumbing fixtures are shown?

2. With a colored pencil draw lines on the blue print showing working layout of soil, waste and vent lines, cold-water lines, hot-water lines.

3. Assume that the sewer, water and gas mains are in an alley 70′ from the rear of the house. Make an estimate of the number of feet of soil, water, vent and gas pipe necessary to install the plumbing as specified. How many and what fittings are needed? Use the following outline for an estimate of materials required.

A. *Fixtures.*
  Bath, kitchen, etc.

B. *Drainage.*
  Sewer pipe, sewer-pipe fittings, cement, soil pipes, soil-pipe fillings, trap, hooks, oakum, lead.

C. *Water.*
  Pipe, pipe fittings, stop and waste cocks, hangers, bibbs.

D. *Gas.*
  Pipe, pipe fittings.

E. *Miscellaneous.*

EXERCISE XIV

CARPENTRY

TYPE QUESTIONS

1. What sized girders are used to support the first-floor joist?
2. What two sizes of joists are used to support the first floor?
3. What direction do the joists run in the different sections of the building?
4. Where are joists doubled in some cases? (See position of partitions, first-floor plan.)
5. How many lineal feet of 1″ × 6″ will be needed to make the forms for the footings?
6. How many 2′ 8″ × 6′ 8″ × $1\frac{3}{8}''$ doors are shown? What is the size of the casement doors? Make a list showing number and sizes of all doors (using specifications and standard design book).
7. How many two-sash windows are needed? Casement windows? Make a list showing size of all windows.
8. What size floor joists are specified? Make a list of all material required for sills, girders and floor joists.
9. Make a list of all material required for studs.
10. How many board feet are required for the sheathing?
11. Make a complete material survey for all lumber and mill work required for this bungalow.

In making an estimate of materials needed the first step, generally, is to make a tabulated list of all material items, such as Sills, Girders, First-floor Joists, Ceiling Joists, Bridging, Wall Studs, Partition Studs, Plates, Rafters, Lookouts. Sheathing, Flooring, Roof Covering, Porch Ceiling, Cornice, Baseboard, Picture Molding, Shelving, Hook Strips, Door Frames and Doors, Window Frames, Sash, Built-in Features, Nails and Spikes, Locks, Hinges, Sash Weights, Sash Cord, Window Locks, Window Lifts, Cupboard Turns, Coat Hooks, Screens, Miscellaneous.

Opposite each of these items give its description and how ordered, as

Wall Studs	Size	No. Pieces	Size ordered	No. Pieces	F.B.M.

EXERCISE XV

PLASTER AND STUCCO

Plastering and stucco on plain surfaces is measured by the square yard. Ornamental plastering or stucco is measured by the lineal foot. Plastering and stucco usually include the placing of the lath whether of wood or metal unless the work is directly upon concrete, brick or tile. Common wood lath are sold by the 1000. 1000 lath are estimated to cover from 60 to 75 sq. yds. of surface. Metal lath come in sheets, the size depending upon the kind used. Lime plaster consists of lime and sand in varying proportions with sufficient hair and fiber to bind it together until it has hardened. Gypsum or prepared plasters are coming into general use. The manufacturers give directions for finding the quantity of material required and specifications for mixing. Cement stucco is the same as cement mortar; from 10 to 15 per cent of hydrated lime is often added to facilitate working. The amount of material required for plaster or stucco work depends upon the mixture specified, the number of coats, thickness of the plaster, and the kind of lath or building surface used.

QUESTIONS

1. Determine the number of square yards of plastering.
2. Determine the number of square yards of stucco work.
3. Determine the material required for each, after securing necessary data from local builders' supply house.

CHAPTER IV

SPECIFICATIONS

Specifications of Labor and Material required in the erection and completion of a Framed Bungalow to be built for____________________on____________________according to the accompanying plans and specifications as prepared by ____________________, the work all to be under the superintendence of____________________.

Drawings. The drawings to which reference is made herein consist of 13 sheets showing plans, elevations and general detail drawings of both the interior and exterior. The contractor to follow the drawings accurately using figures where given in preference to measurements by the scale. All notes and explanations wherever they appear on the drawing to be carefully followed, as they, with the plans and specifications, are all part of the contract. The architect will furnish any other drawings necessary during the progress of the work; and they shall be binding on the contractor as far as they are consistent with the general drawings.

Bids. Bids will be received at the office of the architect until ____________________. Good approved bond to the amount of ______% of the contract price will be required. The bids to be accompanied by certified check for____________________ payable to the order of____________________. The successful bidder shall be given ____________________days from the day on which written notice, from the architect, is received at bidder's office or residence, to the effect that he has been awarded the contract, in which to execute a contract and furnish bond as herein required, and if he shall fail to furnish bond as herein required, and if he shall fail to furnish said bond within the said ______________days he shall be deemed to have forfeited all right to said contract, and the said sum of____________________ shall be forfeited to the said____________________as liquidated damages for his failure. All other certified checks shall be returned to the respective bidders on or before the__________ day of____________________. The owner reserves the right to reject any or all bids. Building to be finished on or before ____________________. Contractor to allow as liquidated damages________________per day for each day overtime. The contractor shall during the progress of the work maintain full insurance on said work in his own name and the name of the owners against accident and loss or damage by fire, the policy shall cover all work incorporated in the building and all materials for same in or about the premises, and shall be made payable to the parties hereto mentioned as their interests may appear.

General Conditions. The contractor to give his personal attention to the work, to furnish all material, labor and everything needed, except as hereinafter specified, for the performance of the work in the best manner according to the plans, details, and specifications. The material to be of the best and first quality of the grade specified. Should the contractor introduce any materials different, do any work poorly, or in any manner different from what is here described or meant to be implied, such work or material shall immediately be removed at the contractor's expense, at any time during the progress of the work. The entire work is to be done in the most substantial and thorough workmanlike manner, and with everything complete, and in a finished state, notwithstanding every item necessarily involved is not particularly mentioned, and the contractor will be held to provide all labor and materials for the entire completion of the work, intended to be described, and shall not avail himself of any manifestly unintentional error or omission, should any exist. Should any error or inconsistency appear or occur in the drawings or specifications, the contractor before proceeding with the work, shall make mention of the same to the architect, for proper adjustment, and in no case proceed with the work in uncertainty. No work is to be sublet unless by the consent of the owner, and all waste materials and rubbish is to be removed from the premises at the completion of the work; the building being left broom-clean.

Notice to Bidders. All the contractors bidding on this work shall be sure that they understand all the plans, details, specifications, and conditions thoroughly, for each will be bound by all things appearing therein, whether under any particular heading or not, that in any way affects his portion of the work, should the contract be awarded him.

Subcontractors. The names of all subcontractors proposed to be employed shall be submitted for approval by the architect before they are employed. Subcontractors must be of first standing in their respective lines. The work required of each subcontractor shall be performed in the same manner as though he were a principal to the contract. All transactions with the subcontractors shall be made through the general contractor excepting such instructions or directions as the architect may give to the subcontractors direct.

Test. The contractors shall make or cause to have made any test of the materials or work the architect may require and bear all cost of making same.

Foreman. The contractor shall give the work his constant supervision, both at the site, and at the shops, and shall place a fully competent foreman in charge of the work at the site, who shall remain in charge until all the works are completed, unless removed by reason of sickness, discharged for cause or replaced by the contractor with the written consent of the architect. All directions must be given by the foreman in the absence of the contractor. Incompetent and careless workmen must be removed forthwith by the contractor when notified to do so by the architects.

Permits. The contractor must at his own cost obtain all necessary permits, pay all legal fees and comply with all the State building and sanitary laws and all municipal rules, ordinances and regulations, relating to buildings, and the preservations of public health and safety.

Cutting Away. The contractor shall not cut away any timbers, dig under any foundations, or into walls of other structural parts of the buildings, or in any case allow the same to be done, without the full knowledge and consent of the architect, and shall be held for any damage resulting from any violations of the provisions of this clause.

Surveying. The owner shall establish the lot lines, and all other lines, and levels necessary to the location and erection of the building shall be established and maintained by a competent surveyor, who shall be employed by the contractor.

Defective Work. The contractor shall be held responsible for and must make good any defects arising or discovered in his work within____________________after the completion and acceptance of the same by the architects.

Clearing away Rubbish. The contractor shall clear away from time to time the dirt and rubbish resulting from his operation and shall cover and protect his work and materials from all damage by the elements, or from any other cause during the progress of his work, and deliver the whole clean and in perfect condition. Each contractor shall protect his own work from any damage whatever, except where it is hereinafter specially mentioned for another contractor to do so.

Application of Condition. These conditions and the clauses of the preceding pages shall apply to all branches of the work with equal force, whether the work is done under one entire contract or under several separate contracts.

Tenders. In the reception of tenders for the work the owner incurs no obligation to accept the lowest, or any proposal, the right to accept or reject any bid or any part of any bid is reserved, and each bid shall be construed to cover all the work specified of the class of bid, notwithstanding the bid in recapitulating the same may omit some part.

Specifications and Drawings. This specification and the accompanying drawings are intended to describe and provide for a finished piece of work. They are intended to be co-operative and what is called for by either shall be as binding as if called for by both. The contractor will understand that the work herein described shall be complete in every detail, notwithstanding every item necessarily involved is not particularly mentioned, and the contractor will be held to provide all labor and materials necessary for the entire completion of the work intended to be described, and shall not avail himself of any manifestly unintentional error or omission, should any exist. Should any error or inconsistency appear or occur in drawings or specifications the contractor before proceeding with the work shall make mention of the same to the architect for proper adjustment, and in no case shall he proceed with the work in uncertainty.

Detailed Instructions. Should it appear that the work hereby intended to be done, or any of the matters relative thereto, are not sufficiently detailed or explained on the drawings or in the specifications, the contractor shall apply to the architect for such further drawings or explanations as may be necessary, allowing a reasonable time for the architect to supply same, and the contractor shall conform to the same as part of the contract in so far as they may be consistent with the original drawings. In the event of any doubt or question arising, respecting the true meaning of the drawings or specifications, reference shall be made to the architect whose decision thereon shall be final and conclusive. No alleged oral condonation or inadvertent neglect on the part of the architect will be accepted as an excuse for bad work. Explanations received from employees in the office of the architects will be considered void in case of dispute.

Measurement. Preference shall be given to the figured dimension of the building. The figures when so witnessed are intended to show the exact dimensions for the construction of the building, but the contractor without extra charge shall make such slight alterations as may be necessary to make adjustable parts fit to fixed parts, leaving all complete and in proper shape when done. It will be the duty of the contractor to verify all dimensions given on the drawings and to report any error or inconsistency to the architects before commencing work.

Materials The various contractors shall provide all materials, labor, scaffolding, and appliances necessary for the proper execution of the various portions of the work, the materials shall be new unless otherwise specially agreed upon, and together with workmanship shall be the best of their respective kinds for the uses intended, and shall at all times be subject to the inspection of the architect for approval or rejection.

Faulty Work. Should it become necessary to retain any faulty work which, if remodeled, would cause undue risk, injury or delay, a sum adjusted by the architect, but not exceeding the whole value of such work and materials, if the same were correct, will be deducted from the contract price.

Assistance. The contractor shall render all necessary assistance to the architect, and if required shall furnish him with levels, measurements, etc., on the work or ground, as the case may be. He shall provide sufficient, safe and proper facilities at all times for the inspection of the work by the architect.

Promptness of Execution. It is not incumbent upon the architect to notify the contractors when to begin, to cease or resume work, nor to give early notice of the rejection of faulty work, nor in any way to superintend in such a manner as to relieve the contractor of responsibility or of any consequence of neglect or carelessness by him or his employees or subordinates. All material and labor shall be furnished at such times as shall be for the best interest of all contractors concerned to the end that the combined work of all may be properly and fully completed on contract time.

Duties of the Architect as Superintendent. Unless otherwise agreed, the work shall be carried out under the supervision of the architect or his authorized representative. The duties of the architect, in addition to those elsewhere stated herein, will consist in giving, on application, such interpretation, either in language, writing or drawings, as in his judgment the nature of the work may require, in deciding on the quality and quantity of all workmanship and material, in issuing certificates that the contractor may be entitled to, in adjusting all deductions from or additions to the contract price, which may grow out of alterations of the design or change of plans or extra work after said work is under contract. He will act in constructive emergencies, will order necessary changes and define the true intent and meaning of the drawings and specifications, and will have authority to stop the progress of the work when he may deem it necessary.

Deviations from Drawings. No deviations from the drawings and specifications shall be made in the execution of the work without the written consent and approval of the architect.

Removing Rubbish and Cleaning Building. The general contractor shall from time to time, as directed, remove all rubbish from the building and premises and, at the completion of the entire work, shall clean out the whole building to the satisfaction of the architect.

Responsibilities. The contractors are to be responsible for all violations of the law, to obtain all licenses, and pay all fees and charges arising out of and in connection with the work, they are also to be wholly responsible for all damage suits arising out of or in connection with the work, both on account of parties being injured on the work, damage to adjoining property and otherwise.

Bond. The contractor shall enter into a bond with the owner, in a sum equal to ____________ of the contract price, with two or more good and sufficient securities or a surety company, to be approved by the owner, for the completion and delivery of the said building, at the time specified in said contract, free from all liens and for the due performance of said contract and all the matters and things therein contained on the part of the said contractor to be done and performed.

Contract. All contracts between the owner of the building and the contractor shall be in writing and prepared by the architect, and no contract shall be binding upon said parties until it has been signed by the respective parties.

Water. Water connection has already been brought to curb, the contractor to have same continued to a point where he requires it and to pay for water for building purposes.

Excavation. Excavate for footings of walls, piers, chimneys, etc., to minimum depth 18″ below present grade or to such depth as necessary to secure good foundation. The area under the house to be excavated to have 12″ clearance below floor joist.

Earth excavated to be used for filling in on front porch so as to receive a concrete floor, any remaining earth to be distributed on lot where required for levelling up.

Footings. To be of concrete 1 : 3 : 5 mixture; to be of depth and thickness shown on drawings. Concrete to be one part standard grade Portland cement to three parts clean sharp sand and five parts broken stone or gravel to pass 2″ ring; thoroughly mixed and puddled to the depth and thickness shown. All concrete to be put in and the architects notified and given time to inspect same before foundation is commenced.

Brick work. To be hard common brick. Exposed brick work to be selected brick, using those having best edges. The walls, piers, and chimneys to be built of sizes shown.

All brick work to be laid in rich lime mortar mixed at the time of using with one-fifth its bulk of Portland cement, laid in a full bed of mortar with shoved joint. The joints of chimneys to be struck inside and out. The four top courses to be laid in mortar one part cement to one part sand. Furnish all flue rings required. Place terra cotta flue lining of size shown for kitchen flue.

Turn brick arches under hearths and level up for tile with concrete. Use $\frac{1}{2}''$ × 2″ arch bars over fireplaces.

The contractor to build brick mantel in living-room of hard-burned selected common brick, selected color, laid with recessed joint in colored mortar. Hearth to be of red unglazed tile 4″ × 4″.

Ventilators. Place in foundation wall where shown ventilation openings 1″ wide by 8″ high made by setting brick on end leaving 1″ space between bricks. Make three openings 1″ wide at each place vent opening is required. Place in foundation wall where directed by architect opening 2′ 6″ wide by as much height as possible to get. Opening to have batten door.

Concrete Floor. Front porch to have concrete floor base $3\frac{1}{2}''$ thick of 1 : 3 : 5 mixture, with $\frac{3}{4}''$ top of 1 : 2 mixture, cut in sections as directed. Use clean sharp sand and Portland cement troweled off to a good surface. Gravel or broken stone to pass a 2″ ring. The front steps to be of cement as specified for floor.

Carpenter Framing. To be of common yellow pine square edged and sound, free from defects that impair its strength and durability; to be of dimensions and spacing as shown on drawings. Double joists at all openings in floor and under all partitions. All floors must be level except on porches where intended to slope. All 2″ × 10″ joists to have single row of bridging in center of span. No bridging elsewhere.

Openings over 4′ wide to have 4″ × 10″ header. Floor joists to be of size shown. Ceiling joists 2″ × 6″—16″ o.c. Rafters 2″ × 6″—24″ o.c. Studs 2″ × 4″—16″ centers, double at opening and triple at corners. No woodwork to be placed nearer than 1″ to chimney.

Ceiling joists and rafters to be well braced together in each span with 2″ × 4″ to satisfaction of architect.

Header at front porch to be trussed as shown on detail with bracing of 2″ × 6″.

Furring and Grounds. Fur for chimney breasts, plumbing lines and fixtures, and heads of closets. Use 2″ × 6″ studs at partitions that carry soil pipe so as not to show a break in wall where stack comes.

Put $\frac{13}{16}'' \times 1\frac{1}{8}''$ plastering grounds to all openings in plastered surfaces, also nailing grounds $\frac{13}{16}'' \times 1\frac{1}{8}''$ for finish. Grounds to be put on carefully, set to suit width of casings as no plastering over chopped grounds will be accepted.

Sheathing and Subfloors. Roof to be sheathed solid with No. 2 common $\frac{7}{8}'' \times 8''$, joints made on solid, nailed two nails.

Sheath outside of frame from bottom of sill to plate, also gables with No. 2 common 6″ or 8″ boards, joints made on solid, nailed two nails. Sheathing of walls to be placed diagonally.

Lay subfloor with No. 2 common 6″ or 8″ boards laid diagonally joints made on solid nailed two nails.

Paper Sheathing. Cover outside surfaces that are to be stuccoed with one thickness of Eagles Slaters felt or equal, well lapped.

Roof. Lay in valleys 18″ wide strips of galvanized iron, flash where sloping surfaces meet over vertical surfaces with No. 28 galvanized iron, counterflashed at brick work.

Gutters and downspouts to be of heavy galvanized iron standard construction.

Shingles. All roofs to be covered with slate-surfaced composition shingles to be of a color as selected, to carry inspection label of Underwriters Laboratories, and to be put on according to manufacturer's instructions and carry a guarantee for permanently uniform color, and against curling at edges.

Outside Finish. To be " B " grade, kiln-dried yellow pine, as shown on drawings. Soffit of eaves to be of No. 1 common flooring, dressed side down. Exposed rafter ends to be 2″ × 6″—24″ center, dressed. Brackets to be of solid pieces and as shown on drawings.

Floors of rear porch to be of $\frac{13}{16}'' \times 3\frac{1}{4}''$ No. 1 common matched flooring.

Ceiling of porches $\frac{5}{8}'' \times 3\frac{1}{2}''$ beaded ceiling No. 1 common.

Outside wood steps at rear to be of two pieces $1\frac{1}{8}'' \times 5\frac{1}{2}''$ set $\frac{1}{2}''$ apart; risers $\frac{7}{8}''$.

Place frames in gable where shown on drawings filled with louver ventilator and screen wire placed behind. Place lattice work in front of louver "A" of $\frac{3}{8}'' \times 1\frac{3}{8}''$ set 2″ apart.

Lathing and Plastering. Lath to be standard green lath put on with $\frac{3}{8}''$ key, breaking joints every sixth lath. See that all angles are solid and no lath run behind partitions.

Cover all lathed surfaces with best gypsum plaster, mixed and put on as per specifications of the manufacturer; floated and rodded true to grounds and true in all angles, and over all walls and spaces. After the brown coat is entirely dry finish the bathroom and kitchen 4′ high with troweled coat of gypsum plaster, from which all fiber has been sifted, burnished true and smooth. All other parts of kitchen to be finished with hard white coat. Use 3 pounds plaster Paris and a proper amount of lime putty to each yard. All other parts of the house to be sand-finished in first-class manner.

Stucco. Cover the entire surface with self-furring expanded metal lath, No. 27 gauge. The sheets to be put on vertically with lapped joints, both edges and ends nailed on with $\frac{3}{4}''$ galvanized-iron staples, driven 8″ apart in each row and shower nailed.

Over the lathing give two coats smooth stucco and one coat rough cast. The first coat to be one part cement to two parts sand mixed into a mortar and then mixed with 10 per cent of its bulk of lime putty. Use all the hair in this coat that can be worked in, scratch thoroughly. Keep this coat well sprinkled with water from hose nozzle for two or three days. After the first coat is entirely dry give second coat of the same mixture, floated perfectly true and smooth to grounds. Keep this coat wet as directed for the first coat. After the second coat is entirely dry give last coat of one part cement, one-half part coarse clean sand and one part fine gravel and a small amount of lime putty, mixed into a soft mixture and after thoroughly wetting the surface sprinkle with a flexible steel brush. Care must be taken to keep the woodwork clean. Should any mortar stick to the woodwork it must be cleaned off with water before it dries. This last or (rough cast) coat must be sprinkled to prevent drying. Stucco must under no circumstances be done when glass is in danger of being splashed.

All lime must be slacked at least two weeks before using.

Inside Finish. To be "B" grade, kiln-dried yellow pine, well sanded and cleaned, including sash and doors.

Window Frames. All exposed lumber to be "B" grade, pulley stiles $\frac{7}{8}''$ and have deep weight pockets, steel pulleys, cast-iron weights and woven sash cords. Casement sash to have $\frac{7}{8}''$ frames with wide stops and stools.

Door Frames. Outside doors to be $1\frac{3}{8}''$ with stop fastened with screws; inside door $1\frac{1}{8}''$ frames with $1\frac{1}{2}''$ mold stop.

Sash. All sash to be No. 1 yellow pine, $1\frac{3}{8}''$ thick.

Mullion sash to have molds clean cut and copings well made. All glass of 60 united inches and under to be S. S. A., all larger D. S. A.

Doors. Front door and doors from living-room to dining-room to be of white pine or cypress $1\frac{3}{4}''$ as shown, glazed with D. S. A. glass set in wood stops. Door from passage to bathroom to be $1\frac{3}{4}''$ thick No. 1 yellow pine, upper portion to be glazed in single Florentine glass using stock pattern. Rest of doors to be $1\frac{3}{8}''$ two-panel.

Screens. The rear porches to be screened as shown on drawing. Screens for double-hung windows to be full length, $1\frac{1}{8}''$ thick. Screening to be neatly fastened on the outside with screen mold. Hang with screen hinges at top end and secure with hook at bottom. Casement windows to be screened on the inside as shown on detail. The screening put on with flush mold. Screens in casement windows to slide up and down, and provided with sliding strips.

All screen doors to be $1\frac{1}{8}''$ thick with mortise and tenon joints. The screen wire to be 16-mesh galvanized screen.

Inside Trim. All baseboards to be of the size shown on detail drawings and all inside openings to be cased in the same manner.

Stock picture mold to be used in all rooms and halls, except the kitchen. Picture mold to be placed as near the ceiling as possible and a wood cornice to be installed in the living-room as shown on detail.

Floors. Living-room and dining-room to have $\frac{3}{8}'' \times 2\frac{1}{4}''$

plain select white oak flooring. Rest of floors to be "B" grade, tongued and grooved yellow pine $\frac{7}{8}'' \times 3\frac{1}{4}''$.

All oak floors to be dressed to an even surface, scraped and sandpapered and covered with building paper, properly tacked down so as to protect the floors until they are finished and left in a completed manner.

Put borders at hearths and shoe at walls of same material as floor.

Cupboards. Kitchen cupboards to be as shown. Lower section to have $1\frac{1}{8}''$ counter top; doors in lower section to be $1\frac{1}{8}''$ thick; upper section to have $1\frac{1}{8}''$ glass door, adjustable shelves, and a ceiled top with a crown mold.

Cabinet for kitchens to be as shown on details. Cabinet in bath room to be of metal $17'' \times 21''$.

Sundries. Build scuttle opening with cover in ceiling where shown on drawing.

Put up where directed one $11\frac{1}{2}''$ shelf on neat cleats and bearers; also $\frac{5}{8}'' \times 3\frac{3}{4}''$ hook strip in each clothes closet. In each linen closet place five shelves full depth of closet.

Put rubber-tip metal door bumpers to all doors.

Hardware. Contractor to supply all rough builders' hardware. The owner to supply finish hardware. Contractor to receive, check and put on same.

Mantel. The contractor to build brick mantel in living-room as specified under "brick work." The contractor to build box mantel shelf of pine with apron, bed mold and brackets as shown on drawings.

Bookcases. Build bookcases in living-room as shown on drawings. Doors to be $1\frac{1}{8}''$ thick; the glass to be S. S. A. set in wood stops. Bookcases to have adjustable shelves as shown on drawing.

Breakfast Nook. Build in breakfast nook a table and seat as shown on drawings. Top of table to be $1\frac{1}{8}''$ thick; sides to be of $\frac{7}{8}''$ thick. Seat to be $1\frac{1}{8}''$ thick with back of $\frac{5}{8}''$ beaded ceiling with neat mold at top. Sides of seat to be of $\frac{7}{8}''$ lumber.

Painting. All material to be of the best quality and to be delivered to the job in the original containers. No paints to be reduced or adulterated in any way except as may be specified.

The architect reserves the right to reject all material or work which is unsatisfactory, same to be made good at expense of the contractor.

The painter shall use all necessary precautions to keep the paint from getting on the hardware, glass, etc., and upon completion of the work shall clean off all spots resulting from his work. He shall be responsible for any damage he may cause to the building.

All exterior woodwork to be given three coats of lead and oil, using one part zinc to nine parts Collier's or Carber's white lead and pure linseed oil in the proper amounts. S. & W. outside white may be used. All nail holes and other defects to be carefully puttied after the first coat. The outside painting includes the inside of the porches. The rear porch floors to be given two coats of approved floor paint. The exterior metal work to be given one coat of red lead and oil followed by three coats of white lead and oil as specified for the woodwork.

All interior woodwork to be given enamel finish in colors as directed, using first-class material, either Ripolin or Vitralite. Give one coat of lead and oil, one coat of enamel undercoater, one coat of half undercoater and half enamel, and one coat of flat finish enamel. Use gloss finish in bath-room and kitchen. Putty all nail holes and other defects after the first coat, rub sufficiently between each two coats to give an even finish upon completion of the work. Edges of shelves in closets only to be finished.

All oak floors to be given one coat of best paste filler with stain in filler if so directed, followed with two coats of "61" floor varnish, rubbed with mineral wool and finished with Johnson's floor wax, polished with weighted brush.

All pine floors except porch floors to be given two coats of "61" floor varnish.

Ceilings and walls above wainscot in bath room and kitchen to be given one coat of varnish size and two coats of flat oil paint; to have even color upon completion.

All doors to be finished with dark mahogany stain, shellacked and varnished.

All remaining walls and ceilings to be left in sand finish.

Wiring. Certificate of acceptance by the City Inspector shall be obtained by the contractor for all electric wiring and delivered to the architects.

All wiring shall be installed as required by the specifications of the Fire Underwriters Code and City Ordinances.

Place outlets where shown on drawings with switches where indicated. All outlets whose capacity is not shown are to be of 60-watt capacity. All bracket outlets to be located at the height desired by the owner, who shall be consulted before they are installed.

All wiring to be concealed and care taken not to weaken the framing by cutting joists, studding and headers.

Place a header at all outlets. All local switches to be two-button flush type, H. & H. Arrow, or equal. All finish plates to match hardware.

Service to be brought to rear porch with a suitable metal box, switch, meter loop, fuse blocks, and fuses provided at this point.

This contract does not include any fixtures or drop lights.

Plumbing. Furnish and install all soil pipes, sewer pipes, lead bends, vent pipes, and all other material and labor necessary to make a first-class sanitary job in strict compliance with the City Plumbing ordinances, and pay for all fees.

Run a 1″ service to the building, the service to be not less than 2′ below the ground. Place a 2″ water meter at the curb, installed in a concrete meter box with iron lid. Place stop and waste to drain all piping above the ground, to be operated from the kitchen. Carry $\frac{3}{4}$″ water service to each sill cock, hot-water heater, kitchen and bath-room with $\frac{1}{2}$″ cold-water service to each fixture. Carry $\frac{3}{4}$″ hot-water service to bath room, with $\frac{1}{2}$″ branches to lavatory, bath-tub, shower, and kitchen sink.

Place one sill cock near northeast corner of foundation wall and one sill cock near southwest corner.

Furnish and install the following fixtures complete in every respect ready for use with all exposed piping nickel plated:

One________________tub, No. __________6′ 0″ long with shower complete as shown.

One________________lavatory, No.__________19″ × 24″.

One________________closet, No.__________complete as shown.

One________________sink, No.________20″ × 30″, drainboard 20″ × 24″ without legs.

One________________automatic instantaneous hot-water heater size No._______ with all connections, etc., as called for by the manufacturer.

Gas Fitting. Do all necessary gas fitting, placing outlets where shown on plans. The opening supplying the fireplace to be controlled by a gas valve operated by a key at the right of the hearth. The service pipe to be 1½″ with ¾″ branches for all outlets, where more than one outlet is served the branch to be increased in size in proportion to the number of outlets it serves. Upon completion of the work test the system for leaks.

Place a built-in, nickel-plated heater in wall of bath-room, to be a _____________heater, No.________. All other openings to come out of the baseboard and to be complete ready for attachment to stoves.

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